Nokia Customer Care
6235/6235i/6236i (RM-60)
Mobile Terminals

RF Description and Troubleshooting

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6235/6235i/6236i Mobile Terminal

The 6235/6235i/6236i mobile terminal is based on tri-mode, Code Division Multiple Access (CDMA), dual-band engine. The variants include a tri-mode that without GPS and a tri-mode with GPS.

Figure 1: 6235/6235i/6236i mobile terminal

Note: The 6236i variant is identical to the 6235i variant, except that AMPS is not supported in the 6236i variant.

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RF Components

Following are the components of the RF, bottom and top boards.

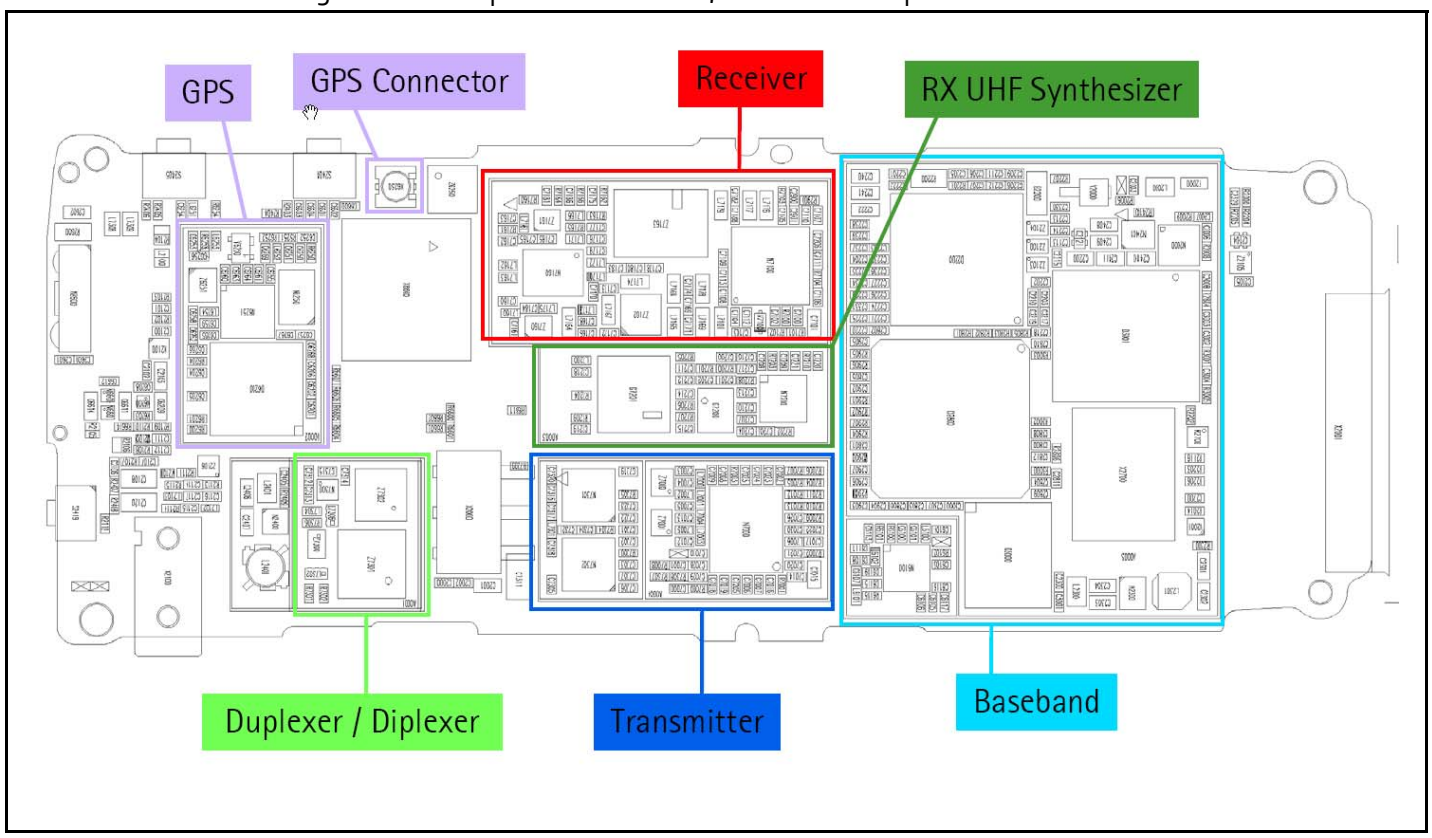

Figure 2: RF component layout – bottom

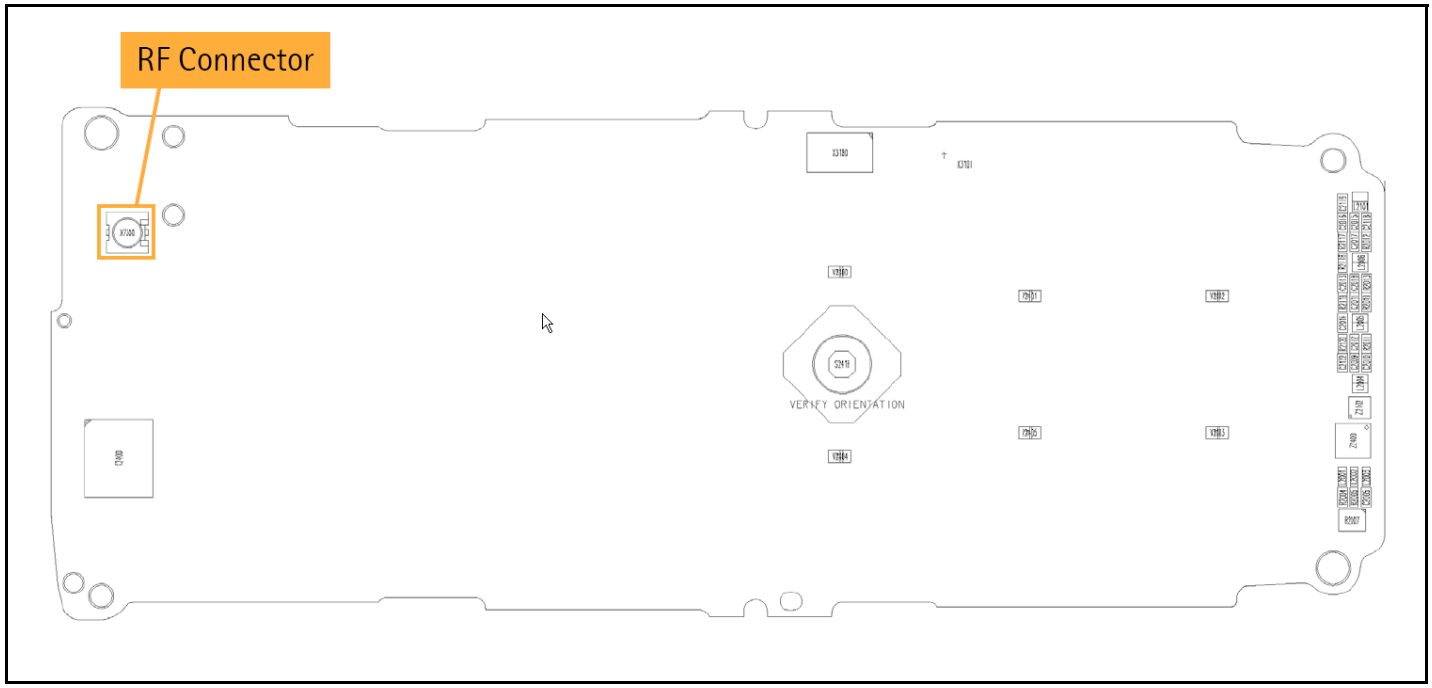

Figure 3: RF component layout – top

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Preliminary RF Troubleshooting

Verify the following if the mobile terminal cannot make a call:

- The mobile terminal is in Normal Mode (i.e., the mobile terminal is searching for a signal, net server is on).
- The Preferred Roaming List (PRL) is loaded into the mobile terminal.
- The mobile terminal is tuned and has passed tuning. Read the tuning parameters using the **Read Parameters** component in Phoenix. An untuned mobile terminal has all zeros in the tuning file.
- The call box channel is set for a channel in PRL.
- The SID is correct and entered into the mobile terminal.
- The VCTCXO is centered as described in the "VCTCXO Manual Tuning" section on page 48.
- The transmitter and receiver are working properly in Local Mode. See "Transmitter RF Troubleshooting" on page 8 and "Receiver RF Troubleshooting" on page 28 for detailed information.

RF Troubleshooting Equipment List

You will need the following equipment for RF troubleshooting:

- Computer with AMS version of Phoenix
- Agilent 8960 CDMA call box (or equivalent)
- Signal Generator
- Power Supply
- Digital Multimeter
- Diagnostic Test Jig (MJ-71)
- Spectrum Analyzer
- AMS RF Probe, AAS-10A (p/n0730306) or AAS-10B (p/n0730307)
- Oscilloscope
- RF Connectors and cables
- Optional High Impedance Probe

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Transmitter RF Troubleshooting

Transmitter Block Diagram

Following is the block diagram for the Tx RF system.

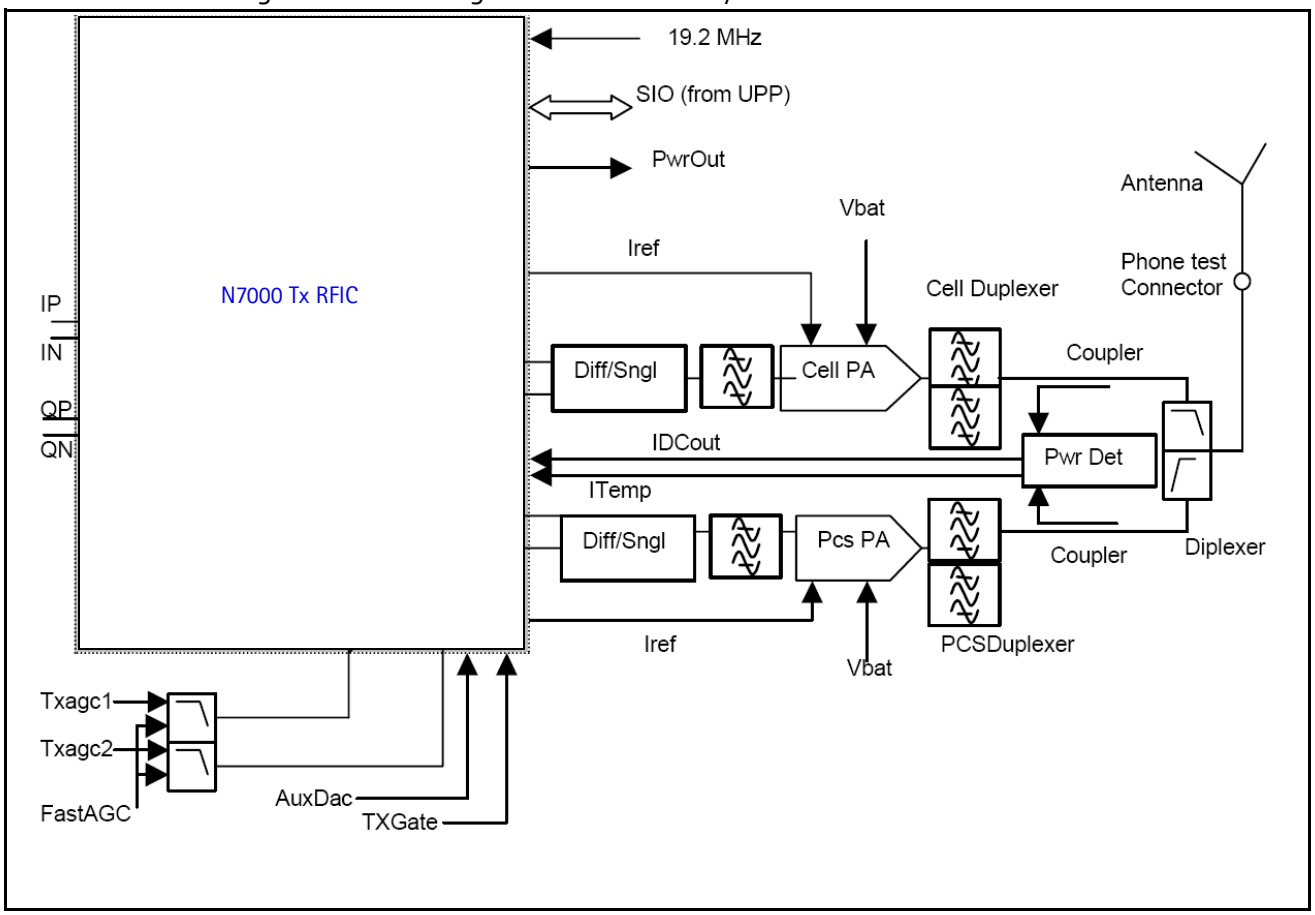

Figure 4: Transmitter system block diagram

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Transmitter Schematics

The following schematics are for general reference only. See the *Schematics* chapter for detailed versions.

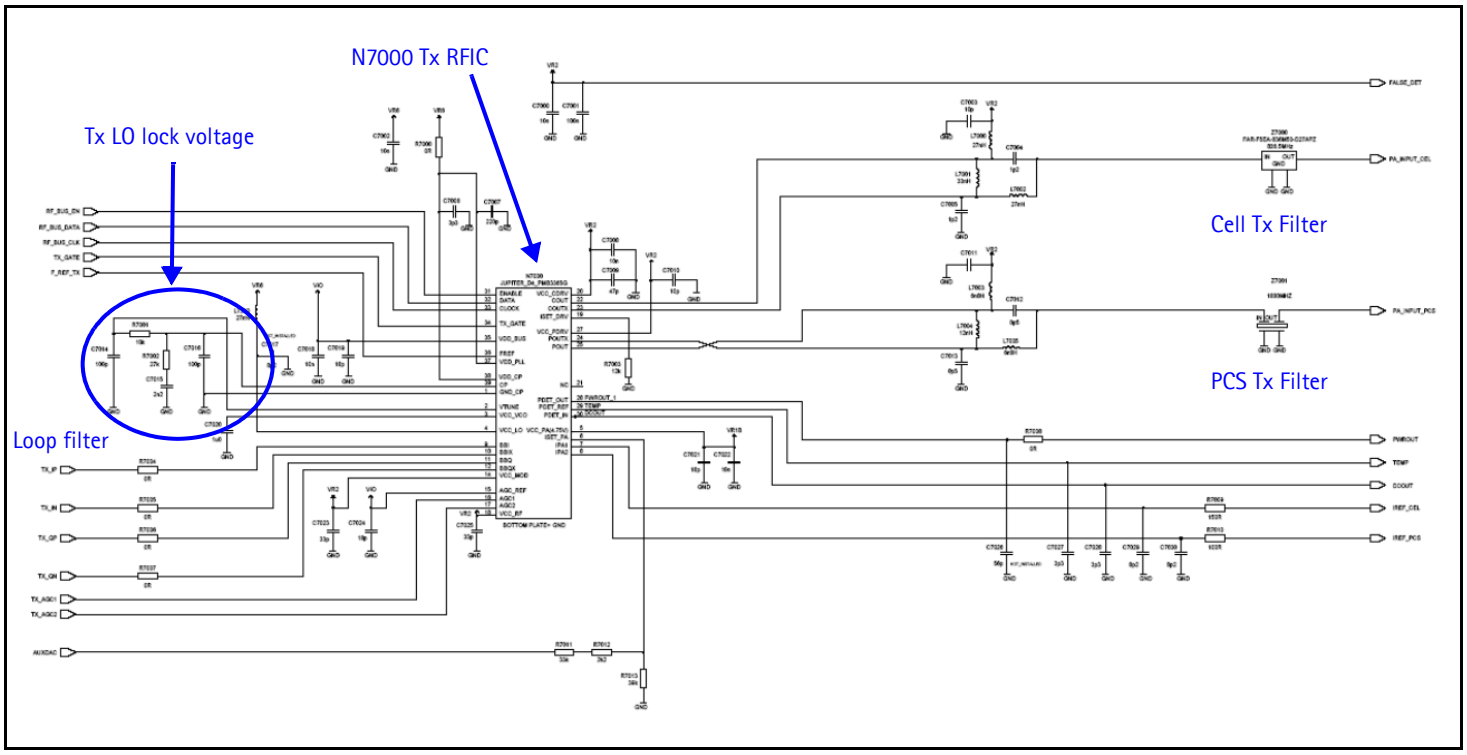

Figure 5: Transmitter schematic 1

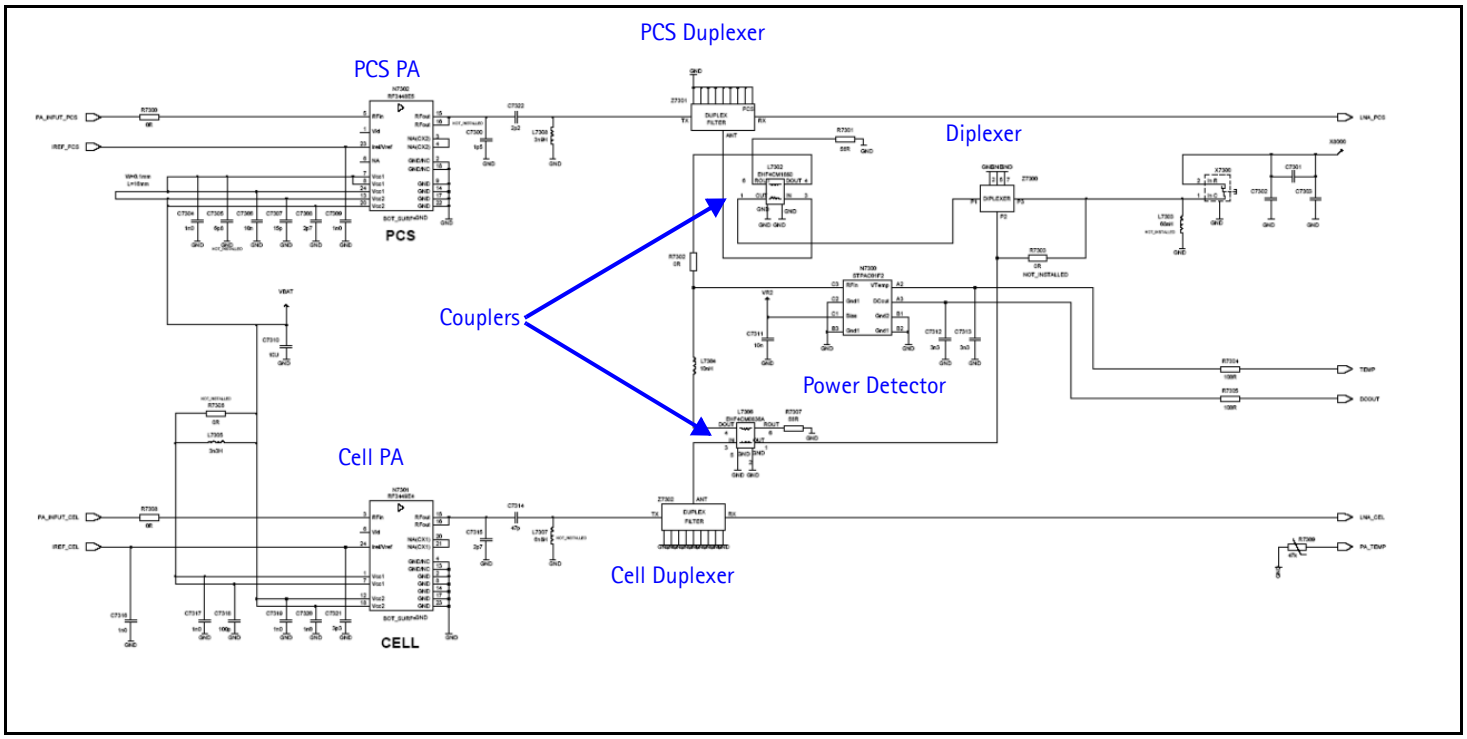

Figure 6: Transmitter schematic 2

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Transmitter Troubleshooting Guidelines

Use some of the following guidelines when as you are troubleshooting.

- Always perform visual inspection of PCB under microscope to check proper placement, rotation, and soldering of components.
- Look for presence of well-defined CDMA modulated signal on spectrum analyzer at correct frequency. If signal is present but off frequency or shape looks distorted, check synthesizer. Possibly, one of the synthesizers is not locked, or VCO has no output signal. Check the synthesizers for proper frequency and amplitude. See "Transmitter Output Spectrum" on page 20 and "Synthesizer Troubleshooting" on page 43.
- Check that power supplies to transmitter have correct voltage See "Tx DC Test Points" on page 22.
- If signal is very low in amplitude, check probing diagram to determine what part of TX chain is 'broken'. See "Tx RF Test Points" on page 23.
- Check that AGC PDMs produce and adjust TX power within the proper limits. See Figure 9 on page 13, Figure 12 on page 16, and Figure 13 on page 18.

Transmitter Troubleshooting Setup

Use the following sets of procedures to troubleshoot the transmitter using Phoenix. Due to the compact layout of the mobile terminal, some of the major test points are not accessible without destroying the shield frames and the EL lamp. For example, duplexers/ diplexer/couplers test points are blocked by the test jig, the PA test points are underneath the shield frame, and the BBIQ points are underneath the EL lamp.

To minimize effort, check the following in order:

1. Tx power at the RF connector.
2. All Tx DC points.
3. All soldering jig points for the whole Tx chain.
4. UHF LO presence:
   - If the UHF LO is present, check the N7000 output.
   - If the UHF LO is not present, it is a synthesizer problem.
5. If there is no N7000 output:
   a. Change the N7000.
   b. If the problem persists, reflow the duplexers, diplexer, and couplers.
   c. If the problem persists, change the PA.
6. If there are several failed mobile terminals with the same symptoms, it may be necessary to break one to determine the cause.

Use the following sections to set up troubleshooting in Phoenix according to the band

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you are using:

- "AMPS Tx Setup" on page 11
- "Cell Tx Setup" on page 14
- "PCS Setup" on page 16

AMPS Tx Setup

Use the following procedures to prepare for AMPS Tx troubleshooting using Phoenix. Note the 6236i variant does not support AMPS.

1. Connect the RF test connector to a spectrum analyzer.
2. Connect the mobile terminal to the PC via a test jig. (The bottom connector is a USB port.)
3. Connect a power supply to the mobile terminal.
4. Open the **Troubleshooting** menu, and click **Phone Control**.

   The **Phone Control** dialog box appears.
5. Click the **LOCAL** button in the **Phone State** tab to put the mobile terminal into Local Mode.

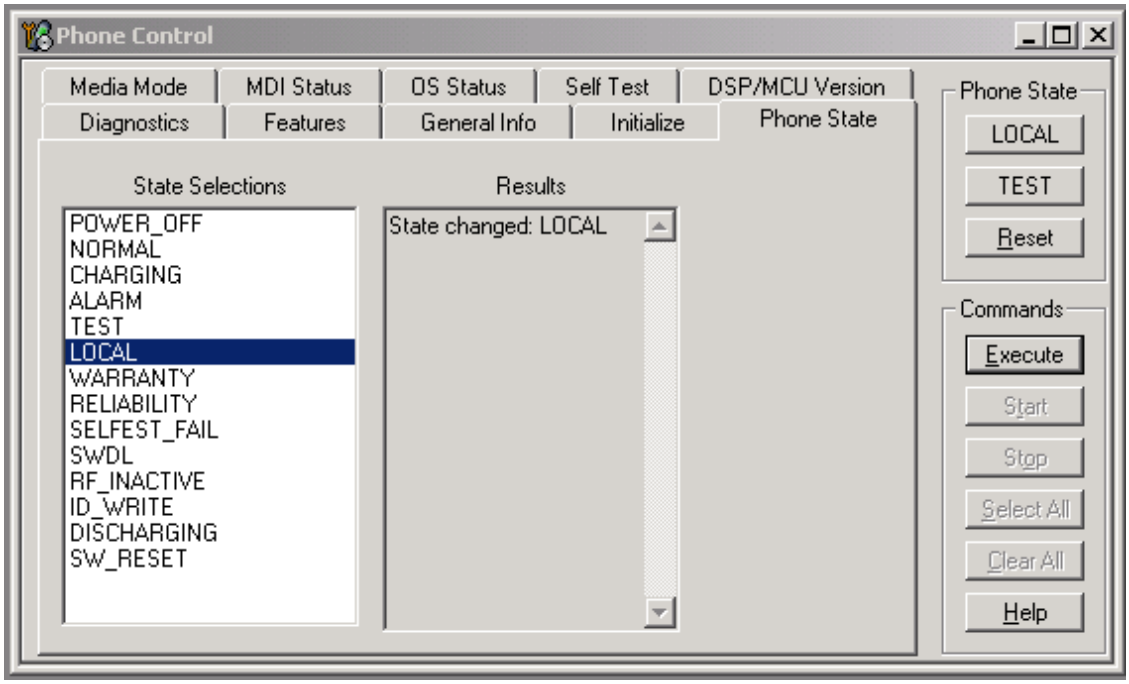

Figure 7: Phone Control dialog box

6. Open the **Troubleshooting** menu, point to **AMPS**, and click **AMPS Control**.

The **AMPS Control** dialog box appears.

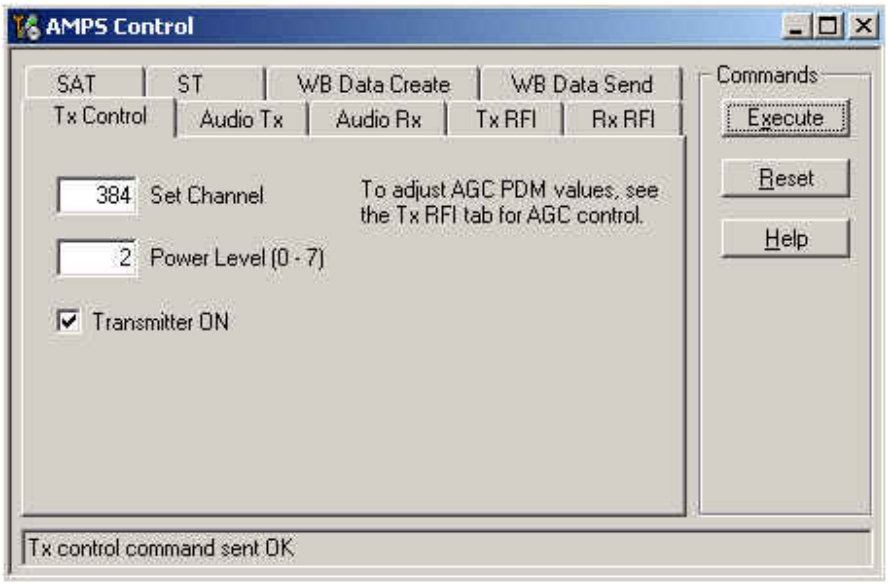

Figure 8: AMPS Control dialog box

7. Click the **Tx Control** tab.
8. In the **Set Channel** field, type 384.
9. In the **Power Level** field, type 5.
10. Select the **Transmitter ON** option, and click **Execute**.
11. Configure the spectrum analyzer using the following values:
    - Center Frequency = 836.52 MHz
    - Span = 100 MHz
    - Amplitude = 20 dBm
    - Attenuation = Auto
    - BW = Auto

Table 1: RF PDM Values at Power Level 5

Description/Field	Reference Value
AGC1	-59
AGC2	-512
PA Gain	-200
Rx IF AGC	+179
AFC	-12
Pout	+17dBm
Current	370mA
Pout w/AAS-10 at Ant. Conn.	-8 dBm

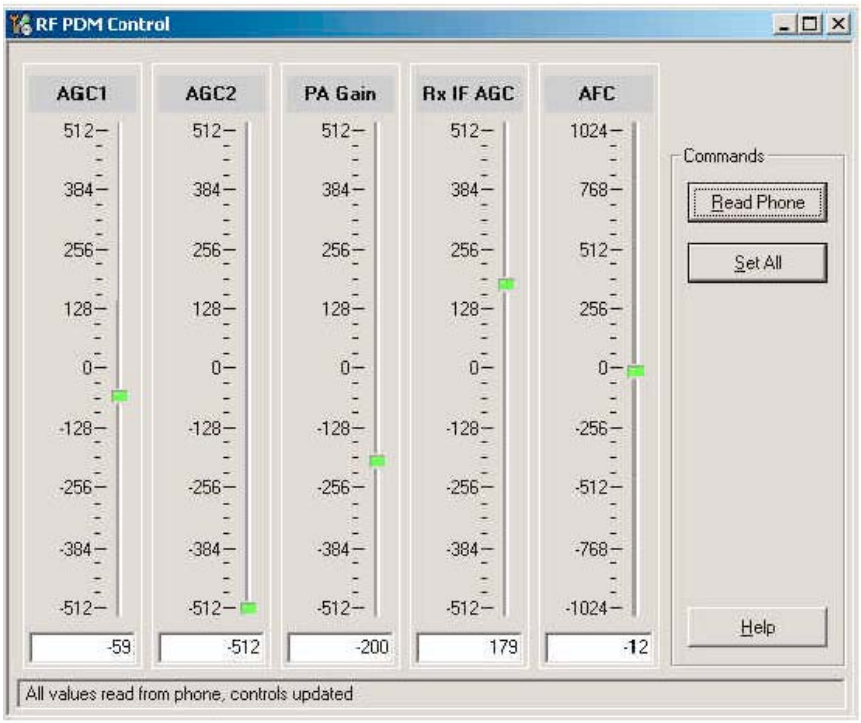

Figure 9: RF PDM dialog box for AMPS

12. Click **Read Phone** to update the values.

Cell Tx Setup

Use the following procedures to prepare for Cell Tx troubleshooting using Phoenix.

1. Connect an RF test connector to a call box.
2. Connect the mobile terminal to the PC via a test jig. (The bottom connector is a USB port.)
3. Connect a power supply to the mobile terminal.
4. On the **Phone Control** dialog box, click the **LOCAL** button in the **Phone State** area to put the mobile terminal into Local Mode. (See Figure 7 on page 11.)
5. Open the **Troubleshooting** menu, point to **RF**, and click **RF Main Mode**.

   The **RF Main Mode** dialog box appears.

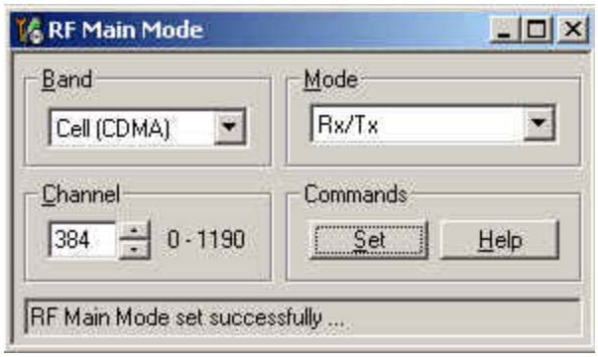

Figure 10: RF Main Mode dialog box for Cell Mode

6. Select the following values on the **RF Main Mode** dialog box:
   - **Band** = Cell (CDMA)
   - **Channel** = 384
   - **Mode** = Rx/Tx
7. Click **Set**.

   Note: Be sure that the "RF Main Mode set successfully" message appears in the status bar.

8. Open the **Troubleshooting** menu, point to **RF**, and click **CDMA Control**.

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The **CDMA Control** dialog box appears.

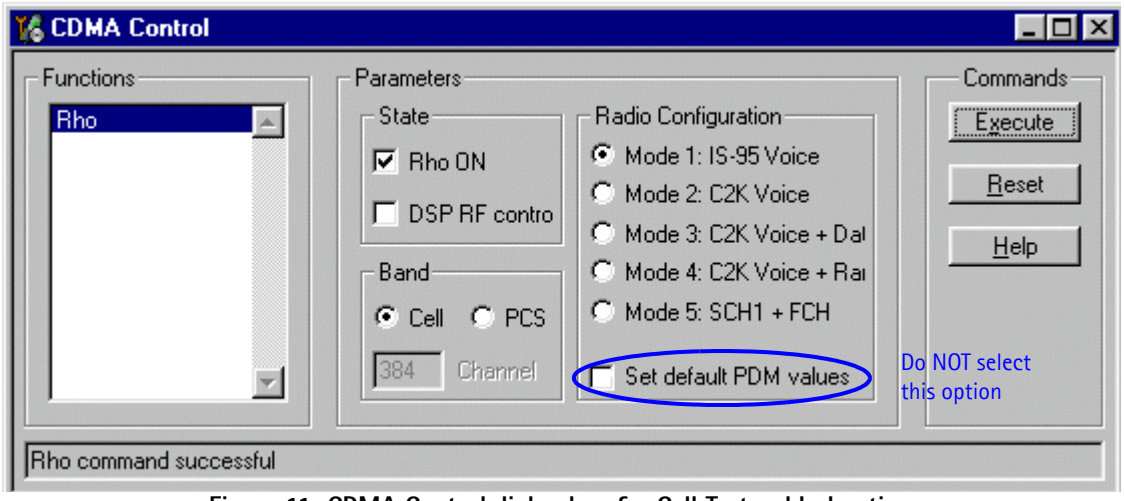

Figure 11: CDMA Control dialog box for Cell Tx troubleshooting

9. Select the following values:
   - **State** = Rho ON
   - **Band** = Cell
   - **Radio Configuration** = Mode 1: IS-95 Voice

   Note: Do NOT select the Set default PDM values option

10. Click **Execute**.
11. Configure the spectrum analyzer using the following values:
    - Center Frequency = 836.52 MHz
    - Span = 100 MHz
    - Amplitude = 20 dBm
    - Attenuation = Auto
    - BW = Auto

Table 2: RF PDM Values

Description/Field	Reference Value
AGC1	0
AGC2	-512
PA Gain	+114
Rx IF AGC	0
AFC	0
Pout	+16dBm
Current	360mA

Table 2: RF PDM Values

Description/Field	Reference Value
Pout w/AAS-10 at Ant. Conn.	-8 dBm

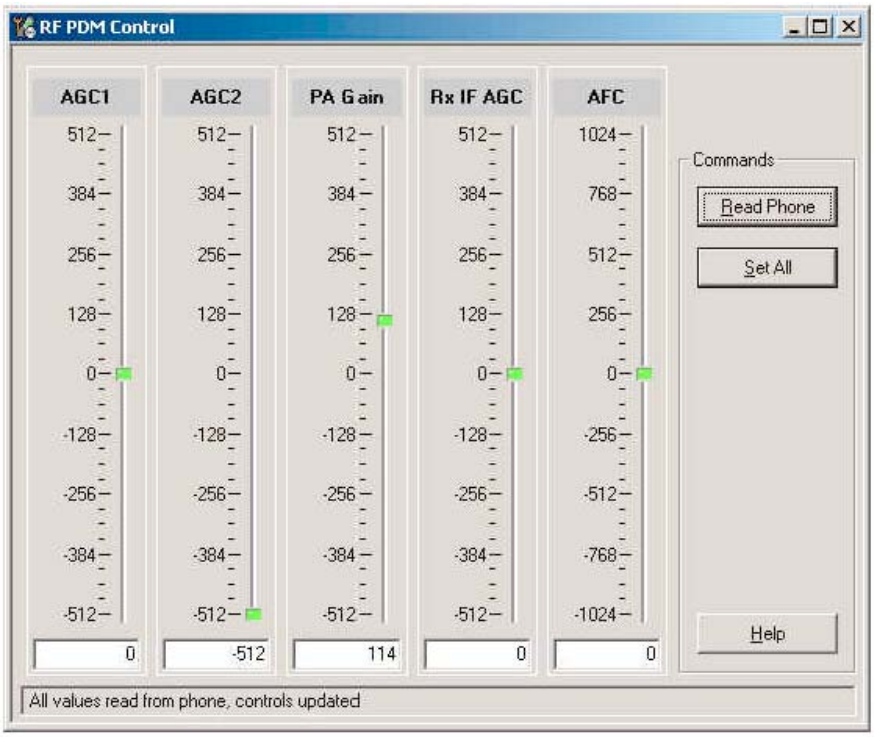

Figure 12: RF PDM Control dialog box for Cell band

12. Click **Read Phone** to update the values.

PCS Setup

Use the following procedures to prepare for PCS Tx troubleshooting using Phoenix.

1. Connect an RF test connector to a call box.
2. Connect the mobile terminal to the PC via a test jig. (The bottom connector is a USB port.)
3. Connect a power supply to the mobile terminal.
4. Open the **Troubleshooting** menu, and point to **Phone Control**.

   The **Phone Control** dialog box appears. (See Figure 7 on page 11.)
5. Click the **LOCAL** button in the **Phone State** area to put the mobile terminal into Local Mode.
6. Open the **Troubleshooting** menu, point to **RF**, and click **RF Main Mode**.

   The **RF Main Mode** dialog box appears. (See Figure 10 on page 14.)

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7. Select the following values on the **RF Main Mode** dialog box:
   - **Band** = PCS (CDMA)
   - **Channel** = 600
   - **Mode** = Rx/Tx
8. Click **Set**.

   Note: Be sure that the "RF Main Mode set successfully" message appears in the status bar.

9. Open the **Troubleshooting** menu, point to **RF**, and click **CDMA Control**.

   The **CDMA Control** dialog box appears. (See Figure 11 on page 15.)
10. Select the following values on the **CDMA Control** dialog box.
    - **State** = Rho ON
    - **Band** = PCS
    - **Radio Configuration** = Mode 1: IS-95 Voice

    Note: Do NOT select the Set default PDM values option.

11. Click **Execute**.
12. Open the **Troubleshooting** menu, point to **RF**, and click **PDM Control**.
13. Configure the spectrum analyzer using the following values:
    - Center Frequency = 1880 MHz
    - Span = 100 MHz
    - Amplitude = 20 dBm
    - Attenuation = Auto
    - BW = Auto

Table 3: RF PDM Values

Description/Field	Reference Value
AGC1	0
AGC2	-512
PA Gain	+207
Rx IF AGC	0
AFC	0
Pout	+8dBm
Current	300mA
Pout w/AAS-10 at Ant. Conn.	-8dBm

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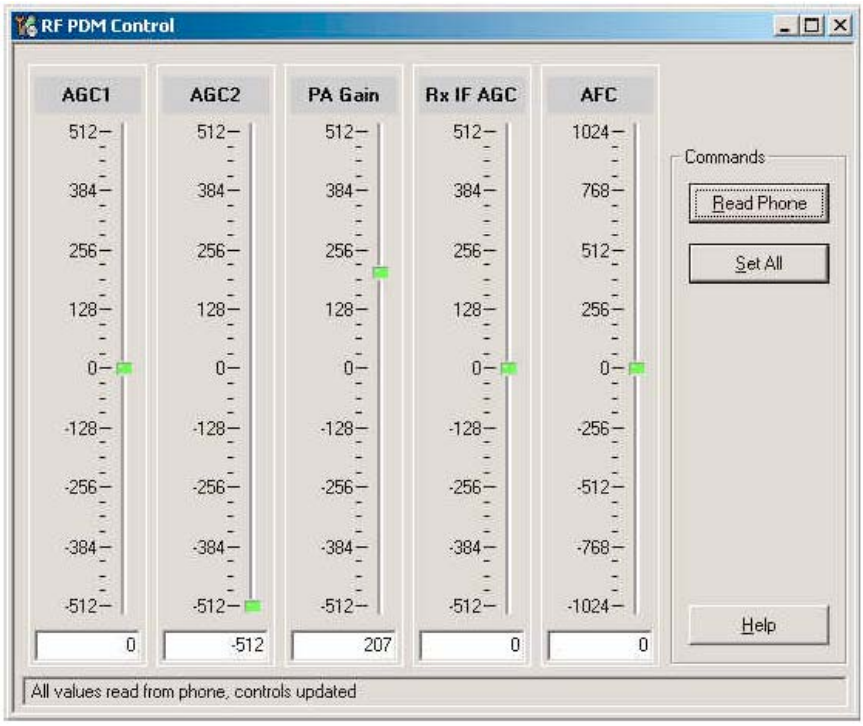

Figure 13: RF PDM Control dialog box for PCS band

14. Click **Read Phone** to update the values.

Transmitter RF Troubleshooting Procedures

After Phoenix is set up using either the AMPS, Cell, or PCS setup procedures, use the following steps to troubleshoot the transmitter.

1. Using a voltmeter, check to see that all VR2, VR6, and VR1B are on the transmit system. (See "Tx DC Test Points" on page 22.)
   - If any are missing, look for SMD problems around the N7000 and the UEME.
   - If SMD is good, replace the UEME.
2. Once all DC voltages are present, check the AGC control voltages. (See "AMPS Tx Setup" on page 11, "Cell Tx Setup" on page 14, or "PCS Setup" on page 16.)
   - If the voltages are incorrect, check the SMD around TX_AGC1 and TX_AGC2.
   - If the SMDs are correct, replace the D2800.
3. Using an oscilloscope, check the input modulation BBIQ wave forms at R7021, R7022, R7023, and R7024. They should all be present with an AC swing of about 500mVpp, with an offset of +1.2V.
   - If one or more waveforms are missing, look for SMD problems around these resistors.
   - If the SMD is good, replace the UEM.

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4. Use an AAS-10 RF probe to probe the Cell Tx output of the N7000.
   - If there is no RF or low RF, look for SMD everywhere around the N7000.
   - If the SMD is okay, replace the N7000.
5. Probe the PA input.
   - If the level is low, look for an SMD issue on the Tx filter or matching transformer (T7001 or T7002).
   - Reflow or replace the filter as necessary.
6. Probe the PA output.
   - If the RF is missing or low, look for Vbatt voltages and SMD issues on and around the PA.
   - If these are okay, replace the PA.
7. Probe the duplexer output.
   - If the RF is missing or low, reflow or replace the duplexer.
8. Probe the coupler output.
   - If the RF is missing or low, reflow or replace the coupler.
9. Probe the diplexer output.
   - If the RF is missing or low, reflow or replace the diplexer.

Failed Test: Tx PA Detector

Use the following steps if you encounter a failed test for the Tx PA detector:

1. Use Phoenix to set the mobile terminal into Local Mode and activate the Tx with default output power.
2. The output power at the RF test connector should be 15dBm +/- 4dB. If not, follow the procedures in the "Transmitter RF Troubleshooting Procedures" section on page 18.
3. Using a voltmeter on DC, probe the detector output at C7313. The voltmeter should read approximately 1.4V. If not, replace N7300. (See "Tx RF Test Points" on page 23 for test point locations and common power and voltage variations.)

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Transmitter Output Spectrum

Following is the correct output of the mobile terminal on a spectrum analyzer with 100MHz span. Note that if you are using the AAS-10 probe with the mobile terminal connected to the call box, the amplitude should be approximately -7dBm at the antenna test point on the top of the PWB.

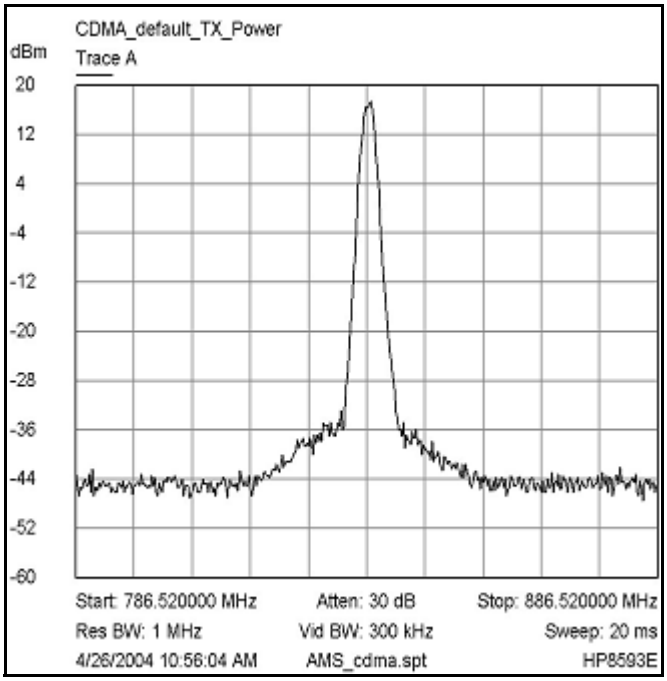

Figure 14: Correct output spectrum

Following is an example of *incorrect* output.

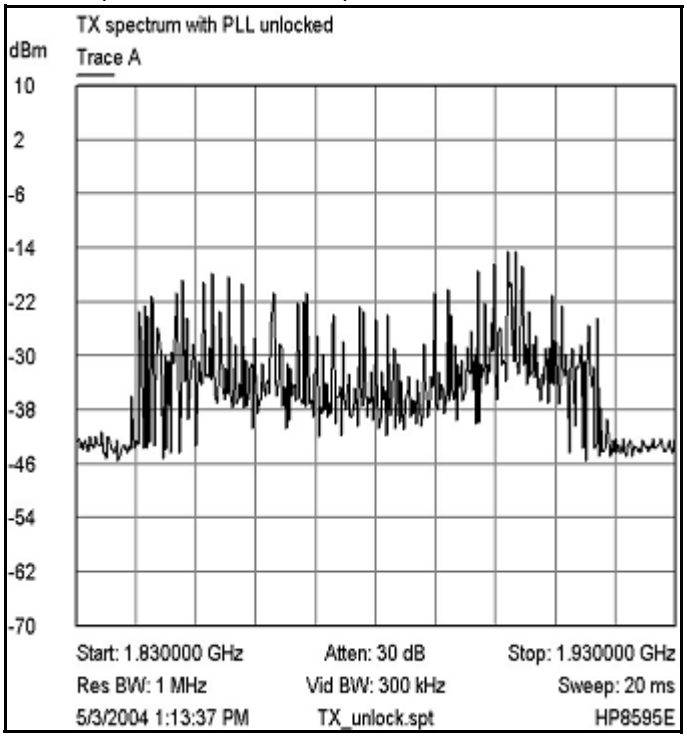

Figure 15: Incorrect output spectrum

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Transmitter Test Points

Tx RF Part Diagram

Following are the transmitter parts located on the bottom side of the main PWB.

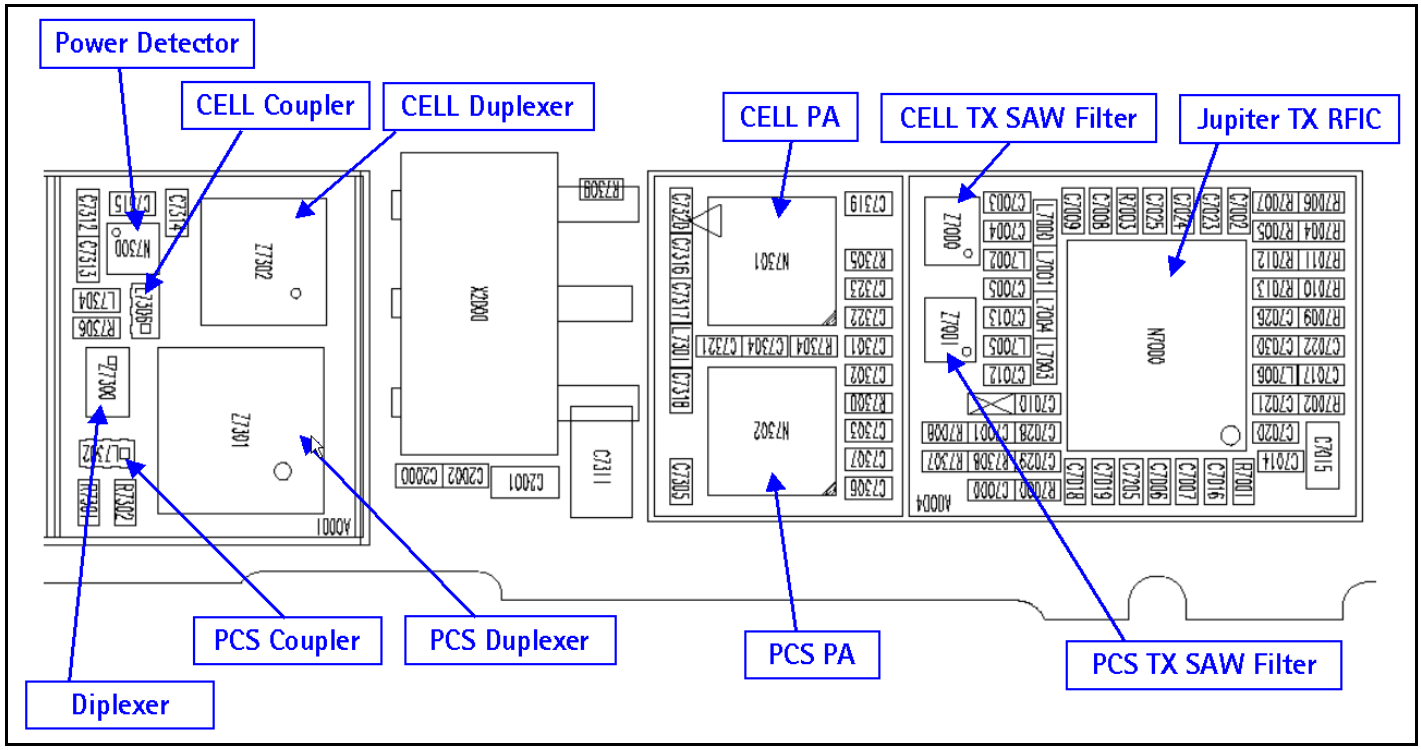

Figure 16: Transmitter parts on the bottom side of the main PWB

Tx DC Test Points

Following are the Tx DC test points located on the bottom side of the main PWB.

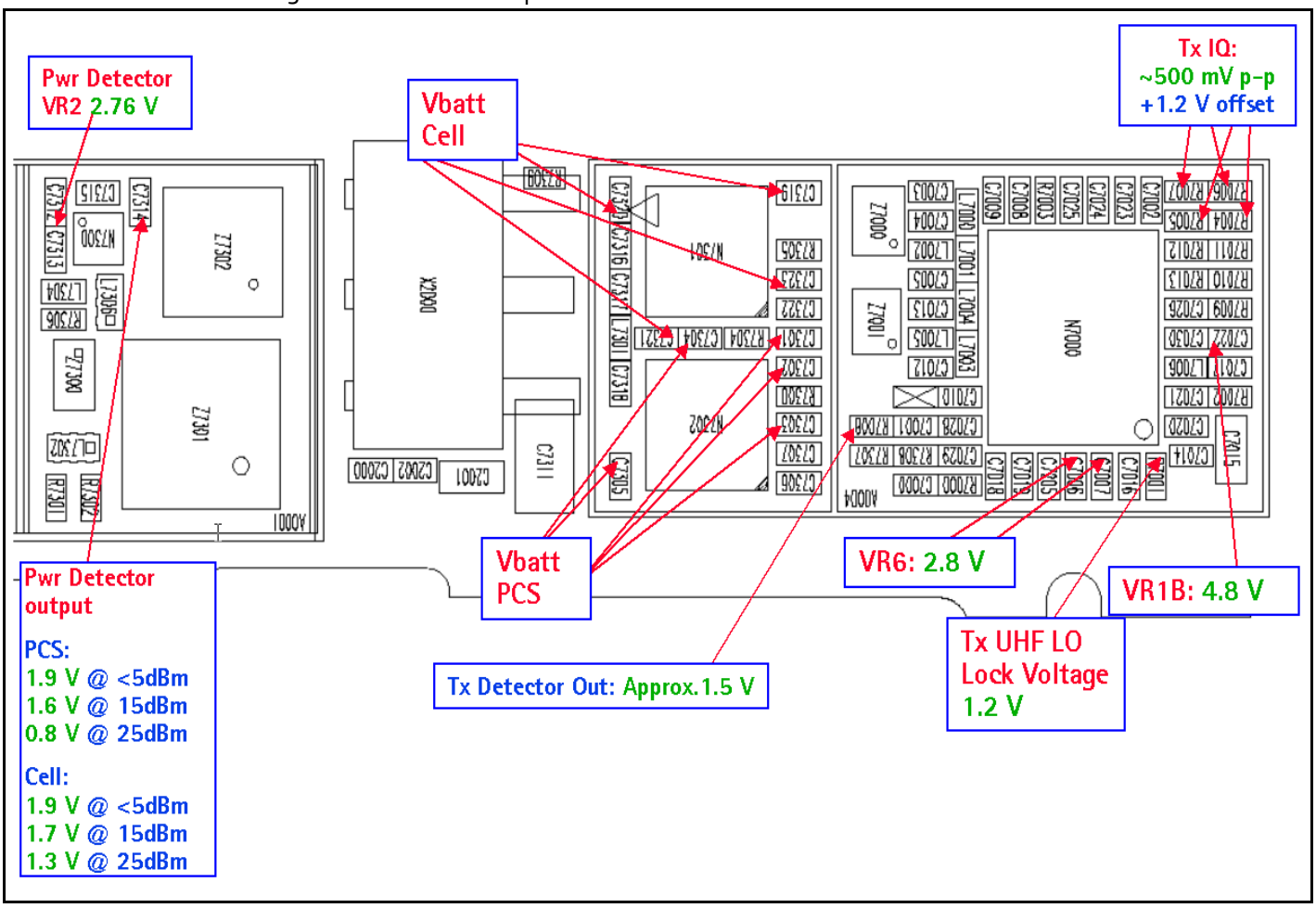

Figure 17: Tx DC test points on the bottom side of the main PWB

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Tx RF Test Points

Figure 18 shows the Tx RF test points located on the bottom side of the main PWB.

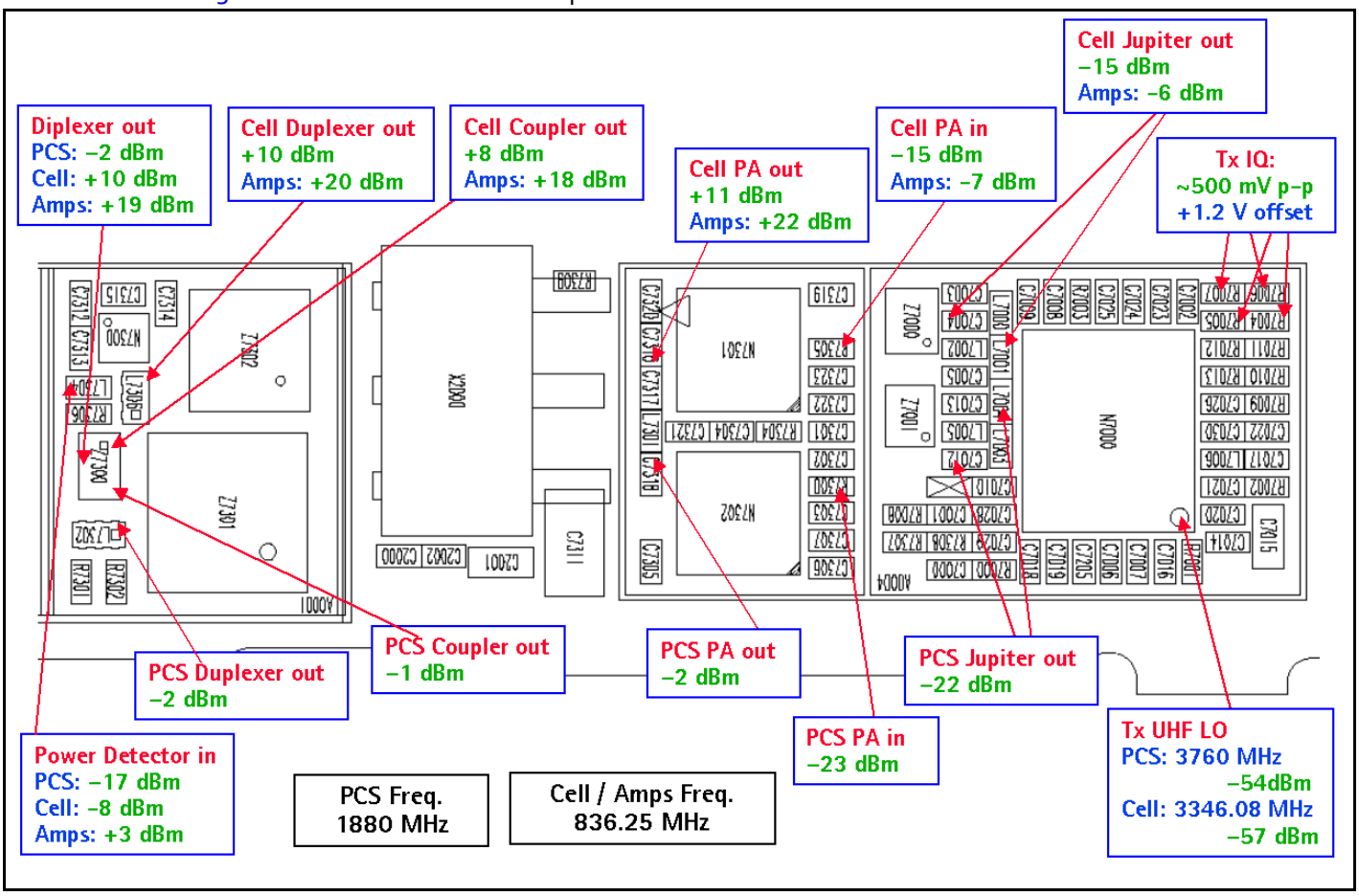

Figure 18: Tx RF test points on the bottom side of the main PWB

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Tx DC Power Supply Test Points

Following are the RF power supply DC test points located on the bottom side of the main PWB.

Rf Supply Lines Resistance to Ground

Note: Always measure resistance with the phone powered OFF

VR1A	>100kΩ to GND	UHF PLL
VR1B	>100kΩ to GND	Jupiter
VR2	7.5kΩ to GND	Jupiter, PA Detector
VR3	>500kΩ to GND	VCTCXO
VR4	4.3kΩ to GND	VCO
VR5	3.2~5.1Ω to GND	Alfred, Batman
VR6	300kΩ to GND	Jupiter
VR7	~ 500kΩ to GND	Batman
VIO	>1MΩ to GND	Batman, Jupiter, UHF PLL
V_{REF}RF1	45kΩ to GND	Batman

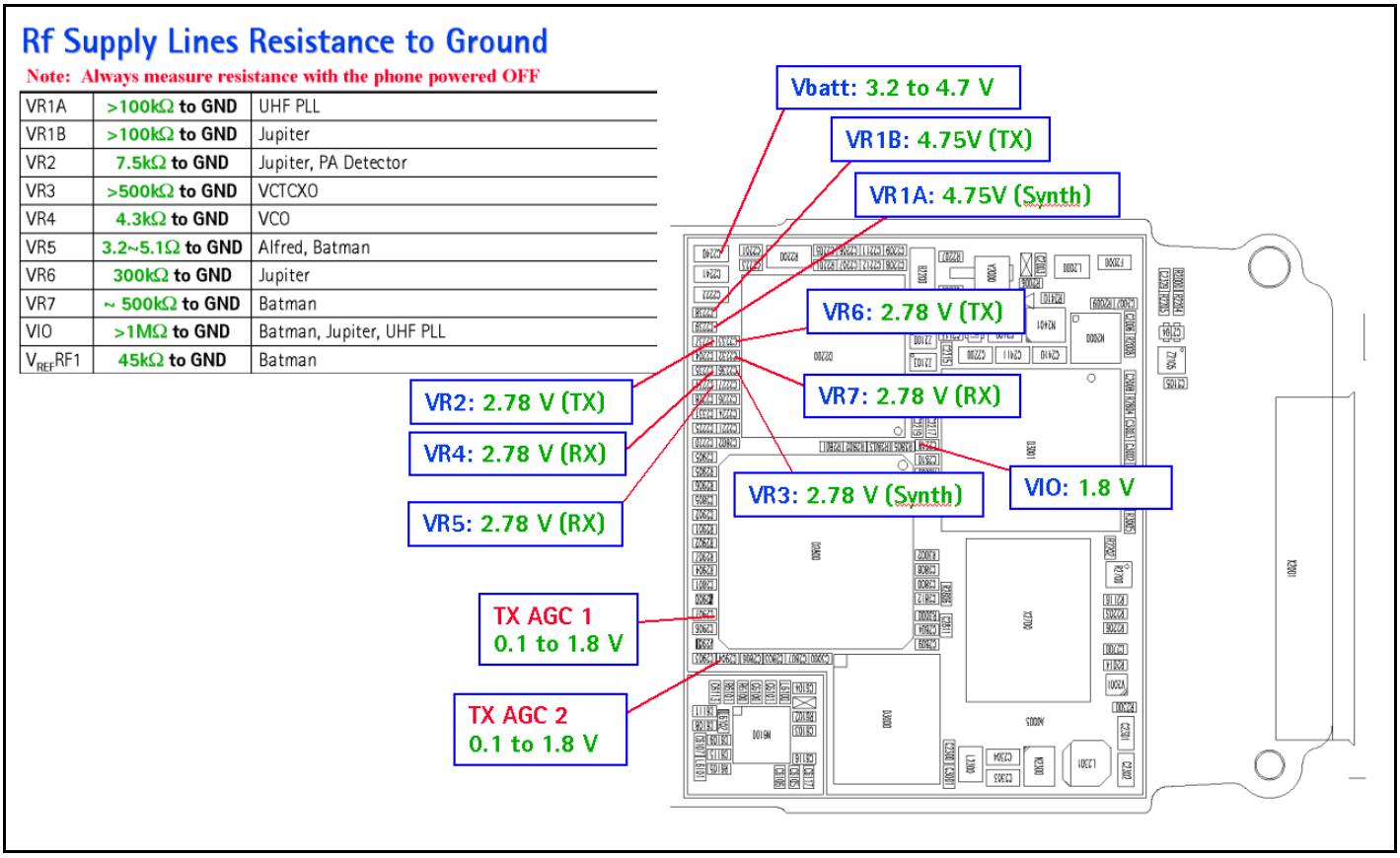

Figure 19: RF power supply DC test points on the bottom side of the main PWB

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Transmitter UHF LO

Tx UHF LO Schematic

There are two fixed LOs; 3296.16~3395.88MHz for cell band and 3700~3819.90MHz for PCS band. This is the first LO for up-conversion. Refer to frequency plan.

Monitor control voltage at C7014. At this control voltage the N7000 LO is locked, should be between 1.2 and 1.8VDC.

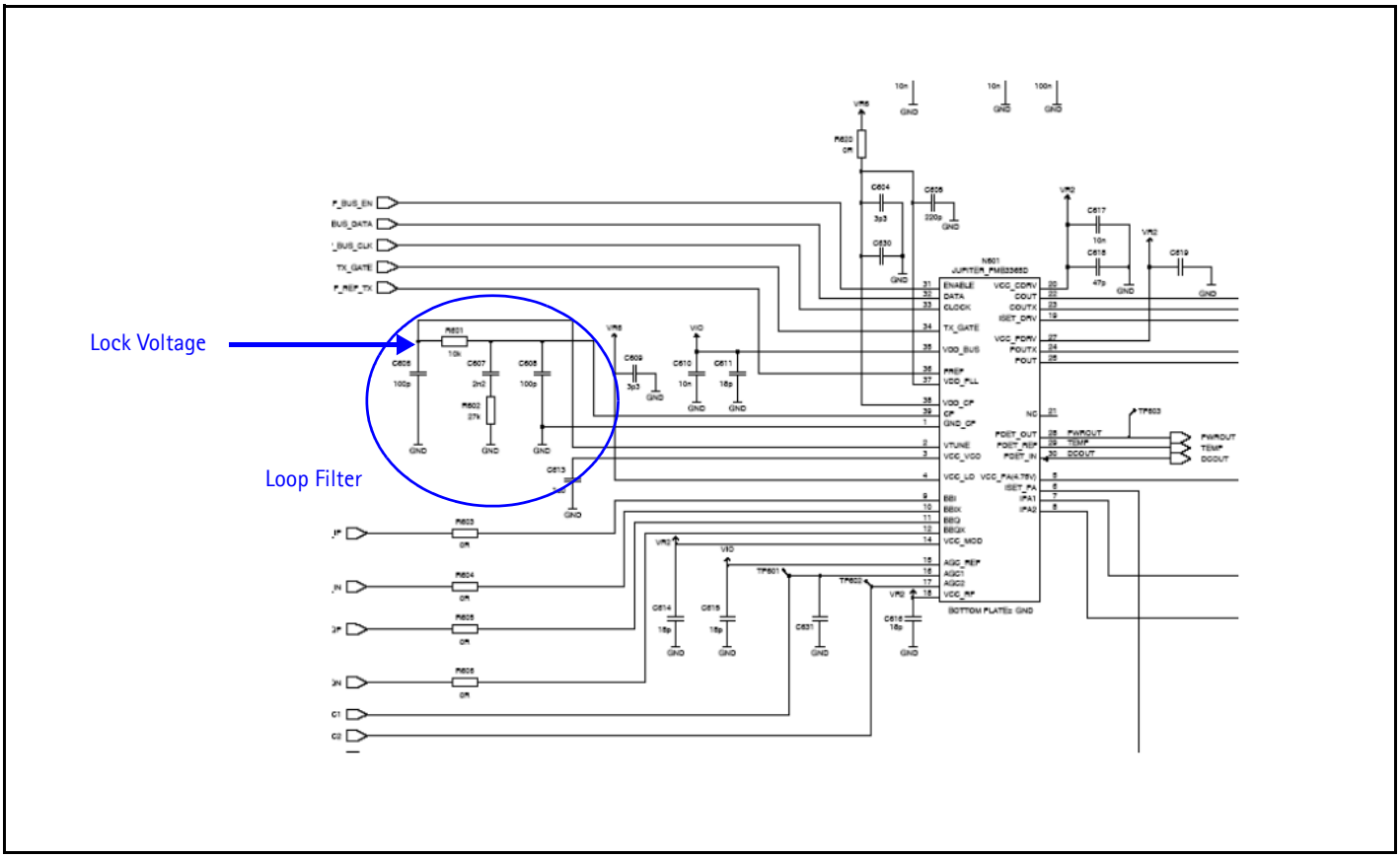

Figure 20: UHF LO Schematic

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Tx UHF LO (N7000) Test Points

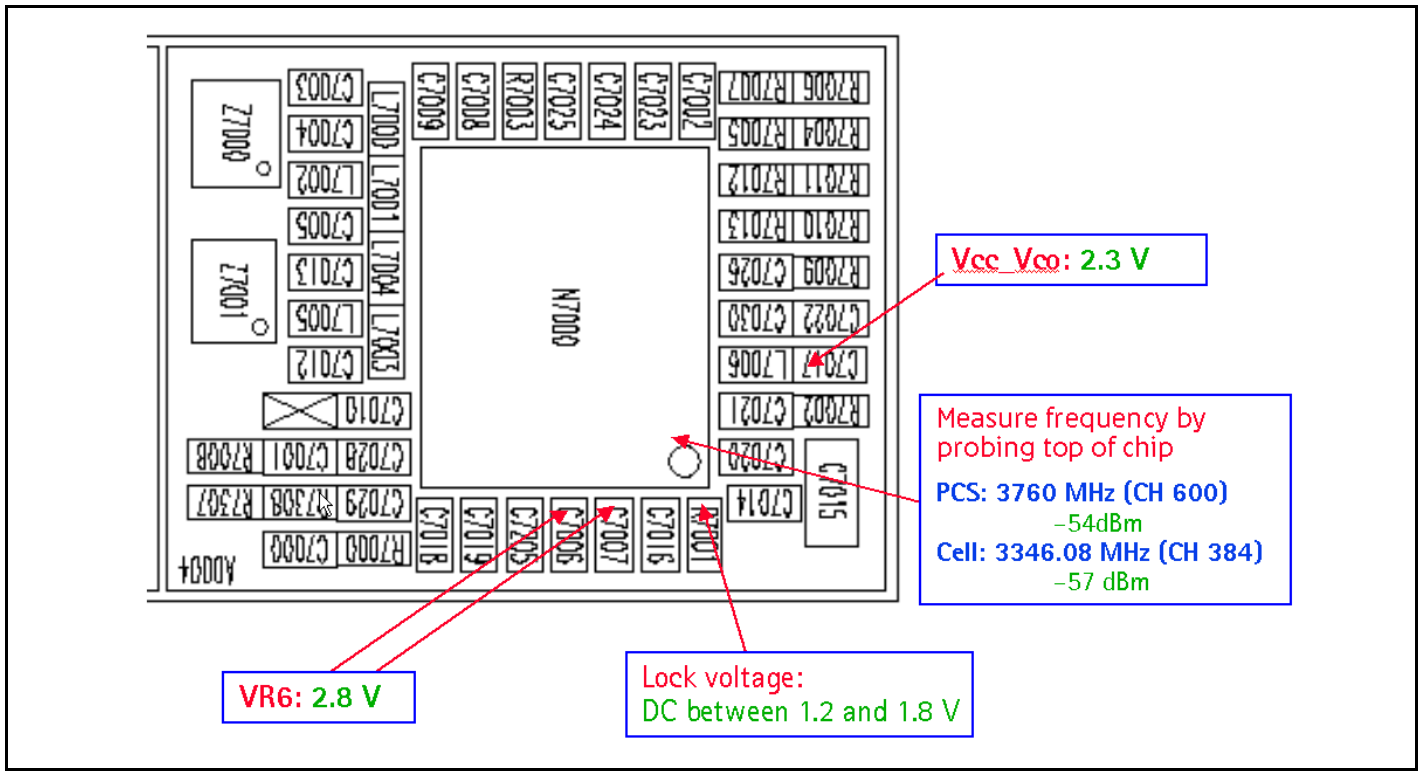

Figure 21: UHF LO (N7000) Block Diagram

PCS Tx UHF Spectrum Output

For PCS analysis of the UHF LO, configure the spectrum analyzer using the following values (see Figure 22):

- Center Frequency = 1880 MHz
- Span = 200 MHz
- RBW = 300 Hz
- VBW = 300 Hz

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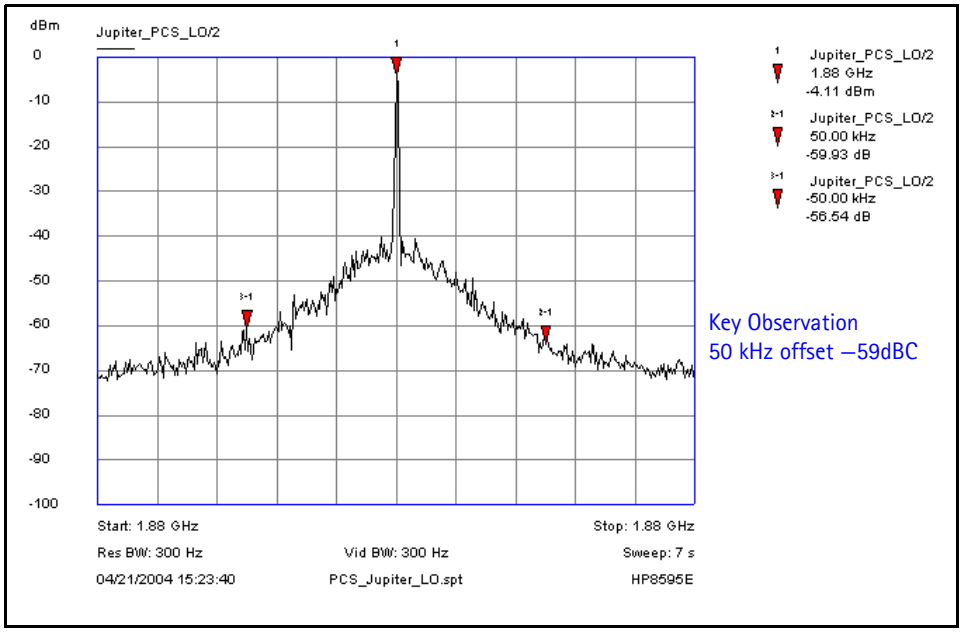

Figure 22: PCS Tx UHF LO Sprectum Output

Cell Tx UHF Spectrum Output

For Cell analysis of the UHF LO, configure the spectrum analyzer using the following values (see Figure 22):

- Center Frequency = 836.52 MHz
- Span = 200 MHz
- RBW = 300 Hz
- VBW = 300 Hz

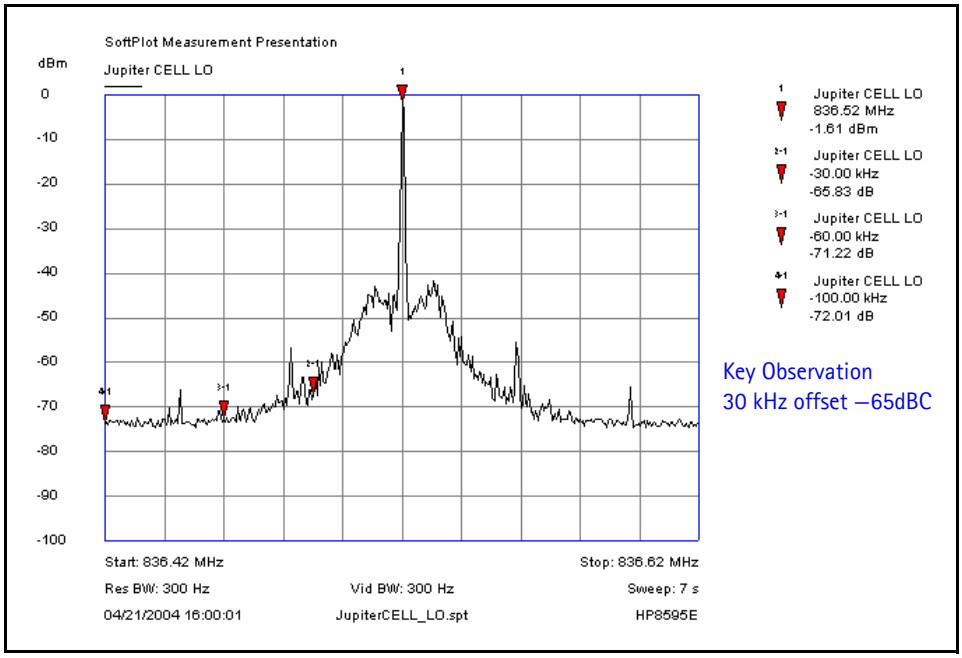

Figure 23: Cell Tx UHF LO Sprectum Output

Receiver RF Troubleshooting

The heart of the receiver is the N7160 Rx IC, which contains two LNAs and mixers. The other components are passive. There are two RF SAW filters for the Cell and PCS bands. In addition, there are two additional IF filters, an IF SAW for CDMA and an IF Crystal for AMPS. The back-end of the receiver consists of the N7100 IC, which handles the VGA and IQ demodulator functions.

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Receiver Block Diagram

Following is the receiver system block diagram.

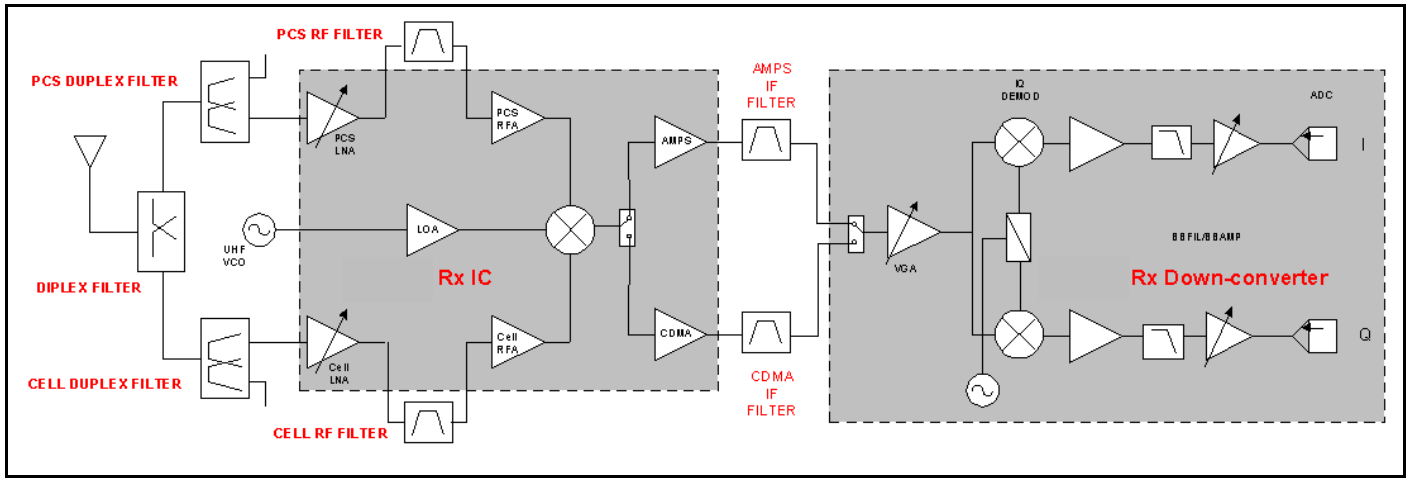

Figure 24: Receiver system block diagram

Receiver Schematics

The main part of the receiver is the N7160 Rx IC. This Rx IC contains two LNA and mixers. The rest of the components are passive. The following schematics are for general reference only. See the *Schematics* chapter for detailed versions.

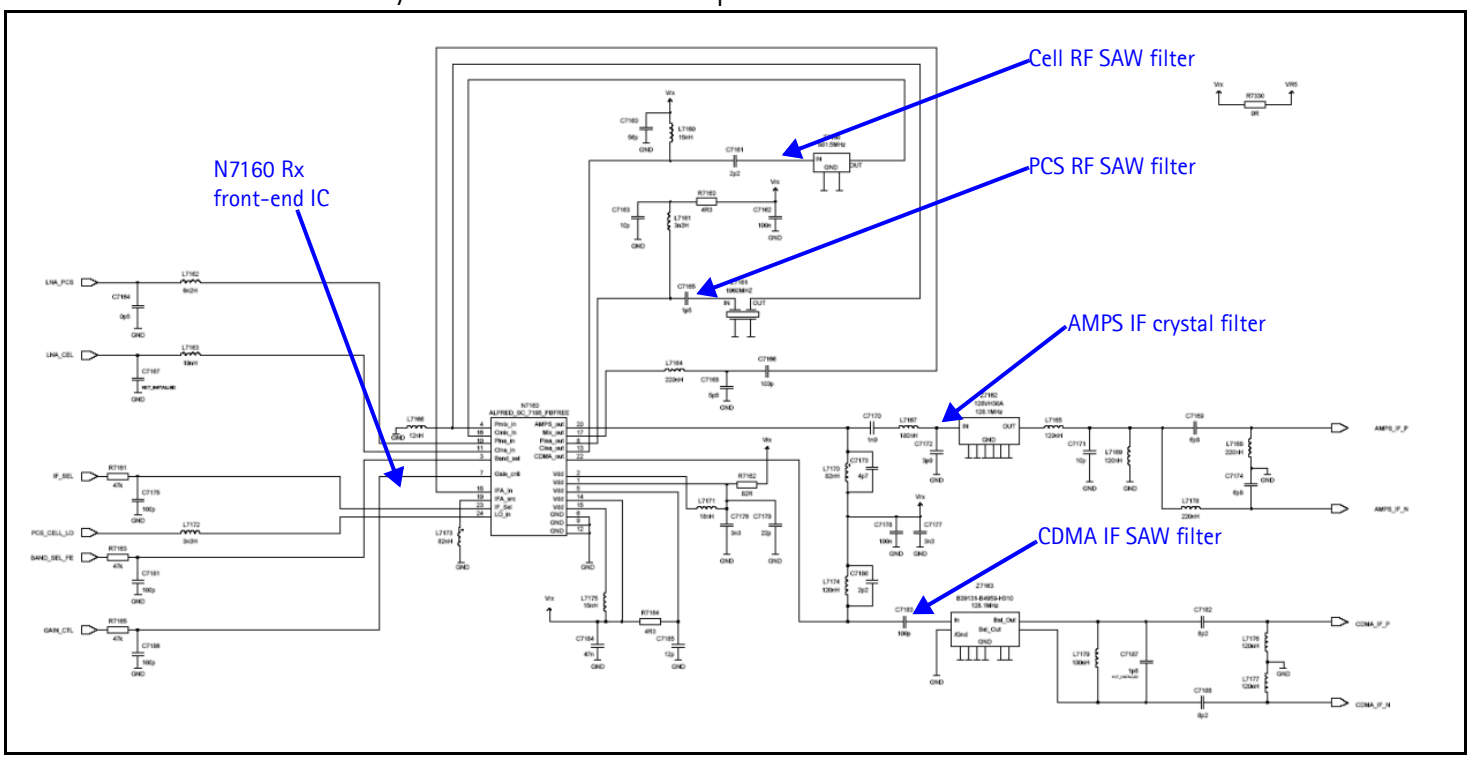

Figure 25: Receiver schematics – 1

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The back-end of the receiver consists of the N7100 IC. VGA and IQ Demodulator are the main functions.

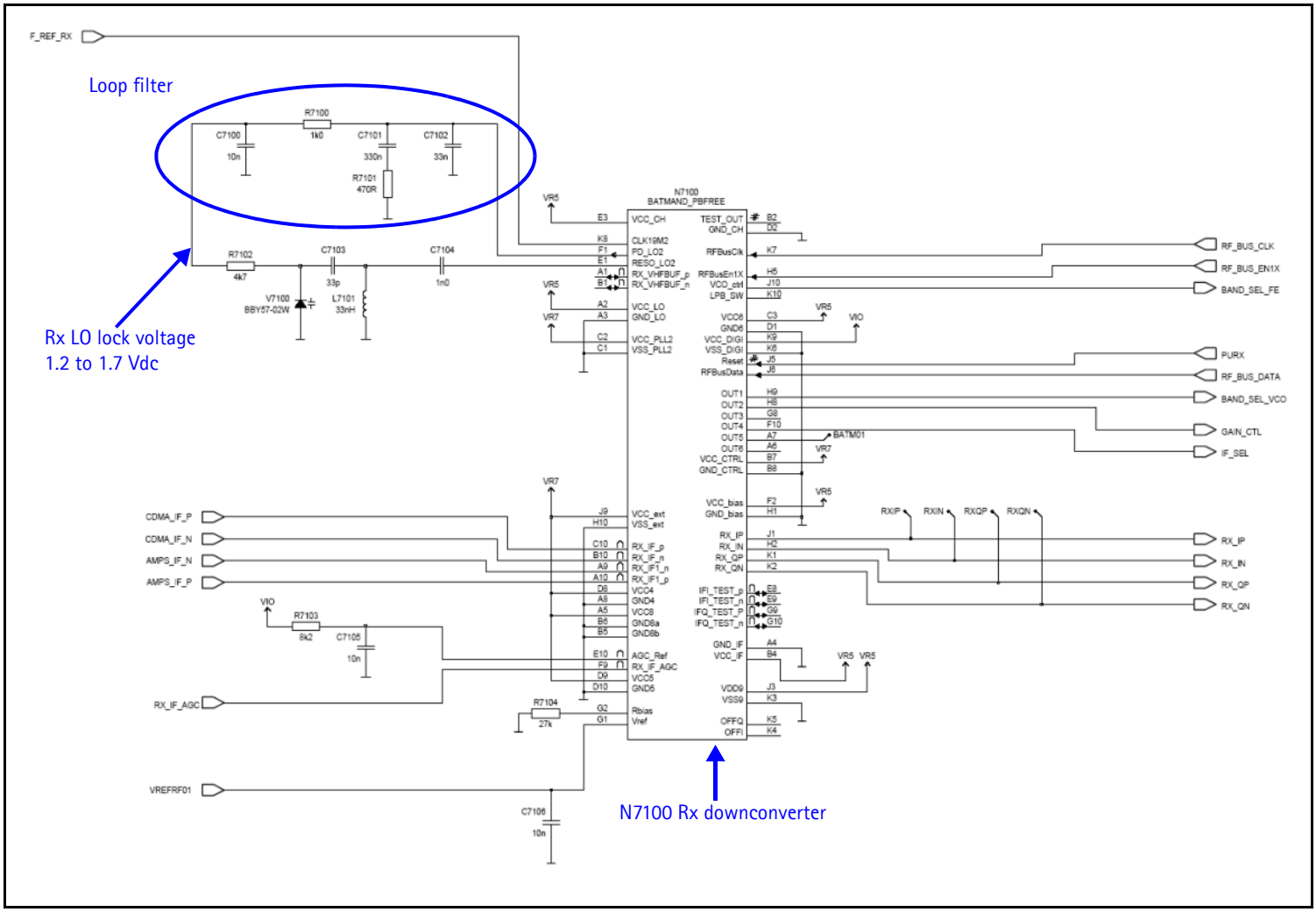

Figure 26: Receiver schematic – 2

RF AGC Status

When configuring the values on the **RF AGC Status** dialog box, note the following:

- The RF AGC status functionality only works in Call Mode.
- In the **PLL Lock Status** area, bright green indicates a locked PLL and dark green indicates an unlocked PLL.
- In the **Baseband Type** field, ensure that the correct baseband is selected (Tiku BB 4.5).

- Clicking the **Stop Updating** button allows you to toggle between the **Update Every 2 Seconds** and **Stop Updating** functions.

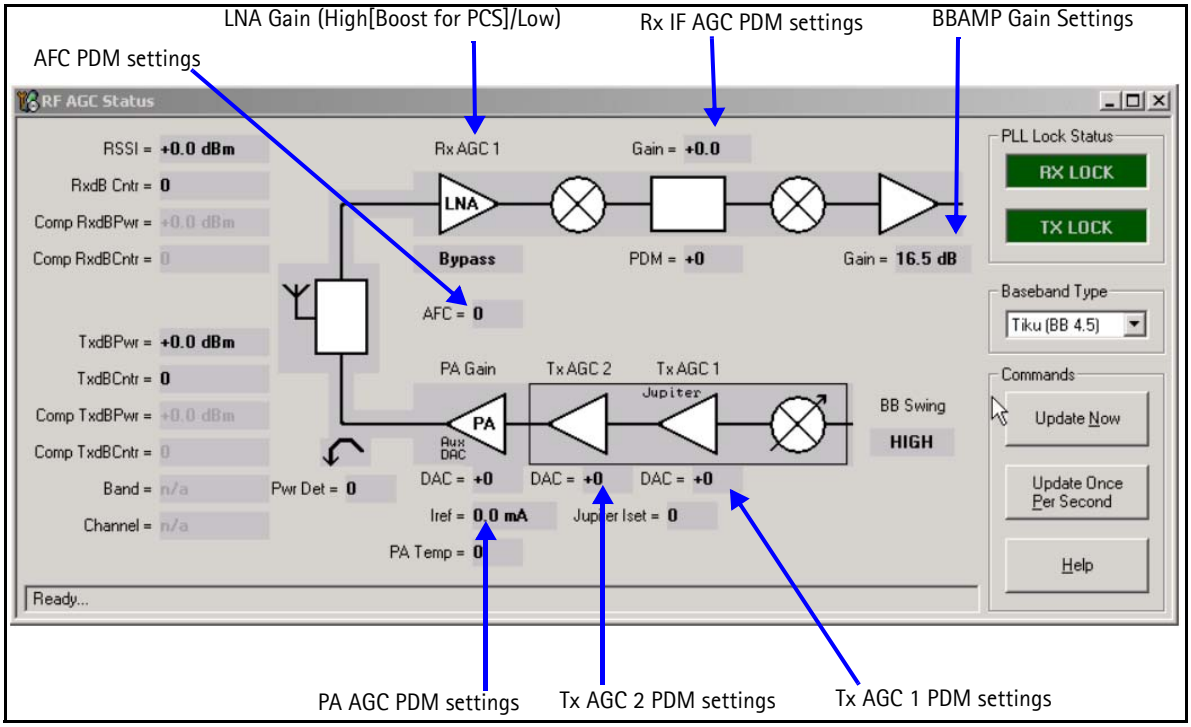

Figure 27: RF AGC Status dialog box

Turning on the Rx Path

Use the following steps to turn on the Rx path using Phoenix.

1. On the **Phone Control** dialog box, click the **LOCAL** button in the **Phone State** area to put the mobile terminal into Local Mode.

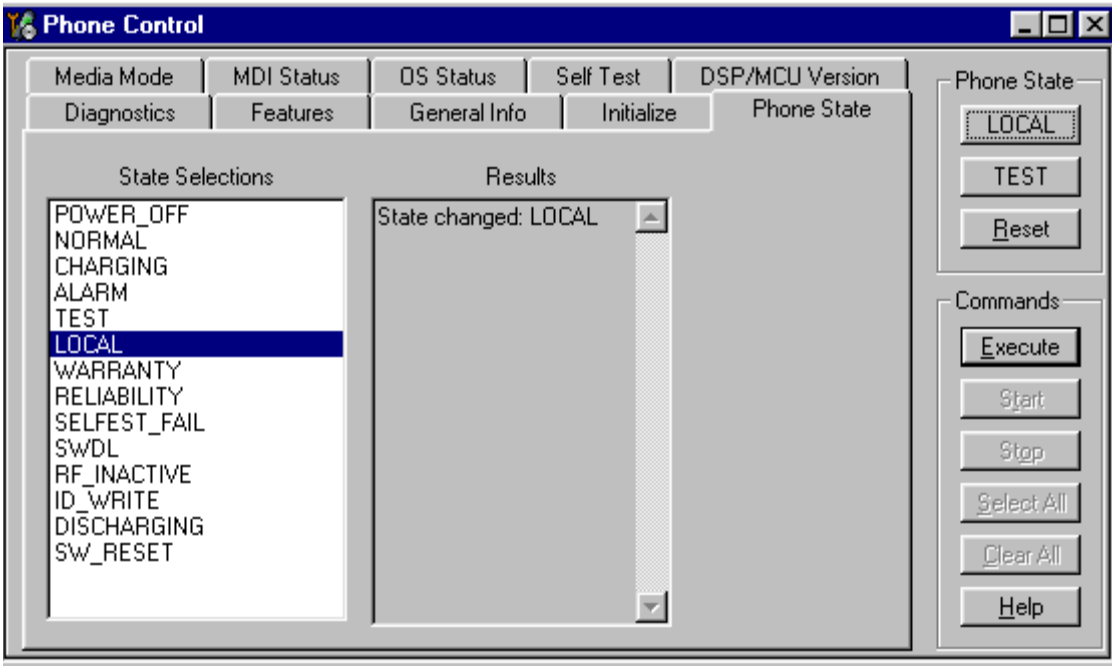

Figure 28: Phone Control dialog box

2. Click the **Execute** button.
3. Depending on the band, use the applicable settings from the table below on the **RF Main Mode** dialog box.

Table 4: RF Main Mode Dialog Box Settings

Band	Mode	Channel
AMPS	Rx = 881.52 MHz	384
Cell	Rx = 881.52 MHz	384
PCS	Rx = 1960 MHz	600

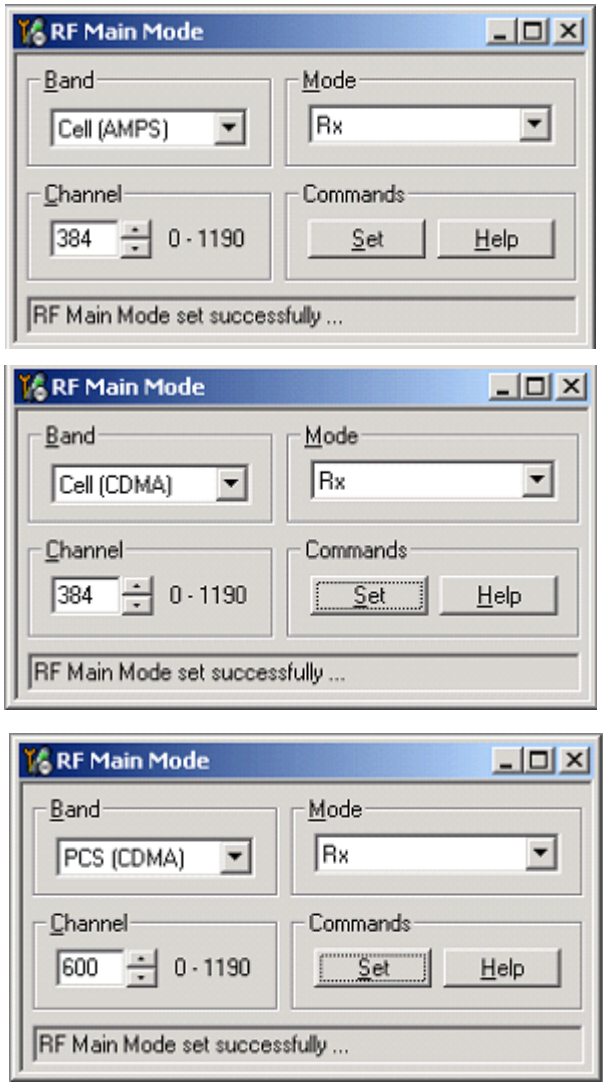

Figure 29: RF Main Mode dialog box for AMPS (top), Cell (middle), and PCS (bottom)

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Switching the Rx Gain States

Use the **RF Gen I/O** dialog box to switch the gain state (Hi and Lo) for CDMA and AMPS modes.

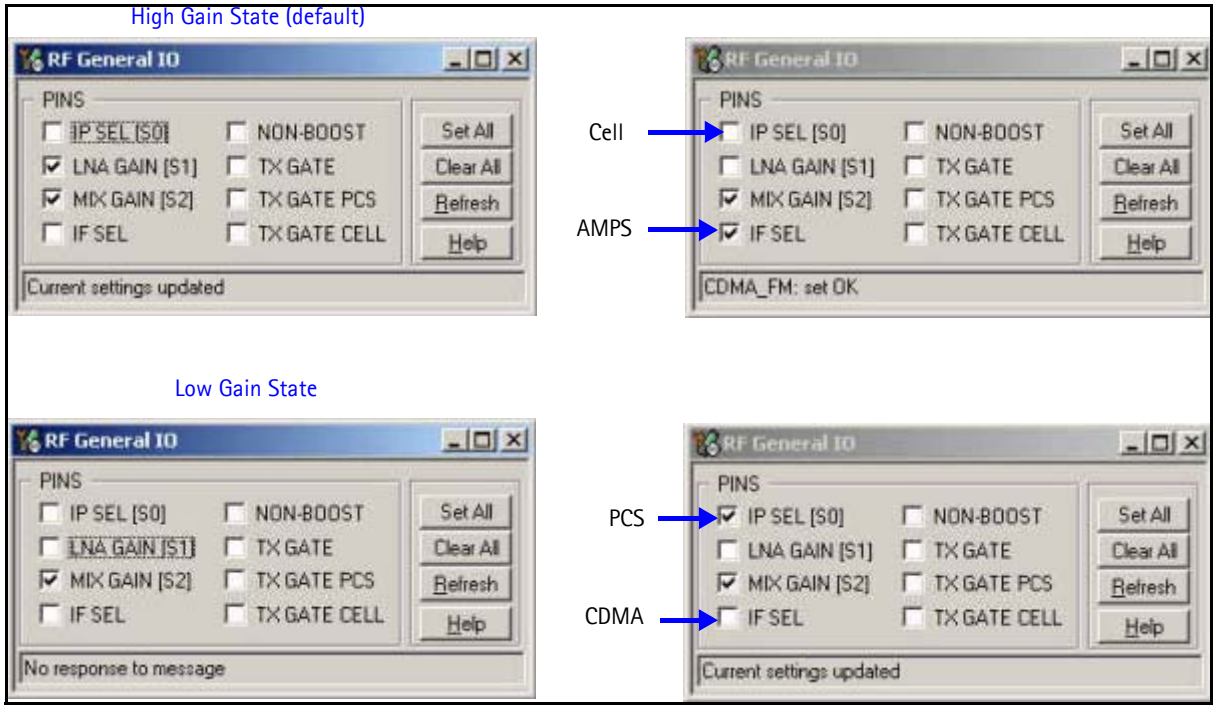

Figure 30: RF Gen I/O dialog box

Checking AMPS from RF to IQ

Use the following steps to check the AMPS receiver functionality from RF to IQ output.

1. Start Phoenix in Local Mode with only the Rx path turned on.
2. Inject a –75dBm CW signal of 881.53MHz (i.e. 10kHz offset from 881.52MHz) into the RF.
3. Measure a 10kHz tone on the analyzer. You should see a typical -20Bm IQ tone for AMPS.

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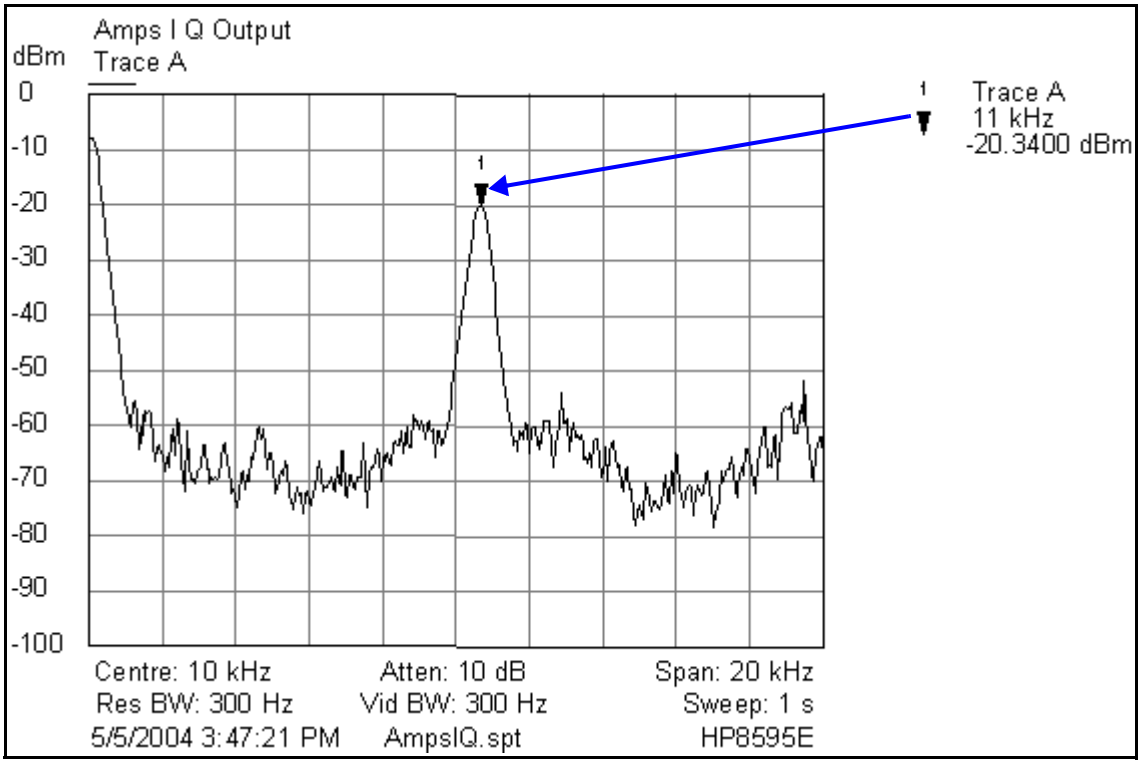

Figure 31: Receiver IQ Level on AMPS band

Figure 32 shows the AMPS spectrum and the test points located on the top side of the main PWB. All four test points should be approximately equal. *WARNING: Direct current is present on these test points.*

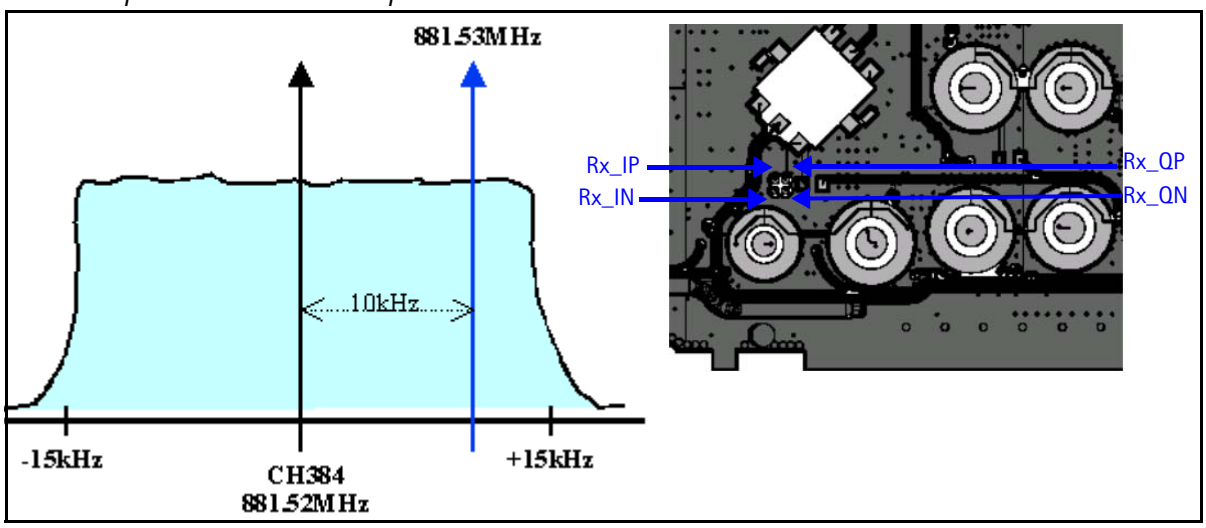

Figure 32: AMPS spectrum and the test points on the top side of the main PWB

Checking Cell Receiver from RF to IQ

Use the following values to check the Cell receiver functionality RF to IQ output.

1. Start Phoenix in Local Mode with only the Rx path turned on.
2. Inject a –75dBm CW signal of 881.82MHz (i.e. 300kHz offset from 881.52MHz or 10 channels away).

3. Measure a 300kHz tone on the analyzer. You should see a typical -21dBm IQ tone for CDMA Cell.

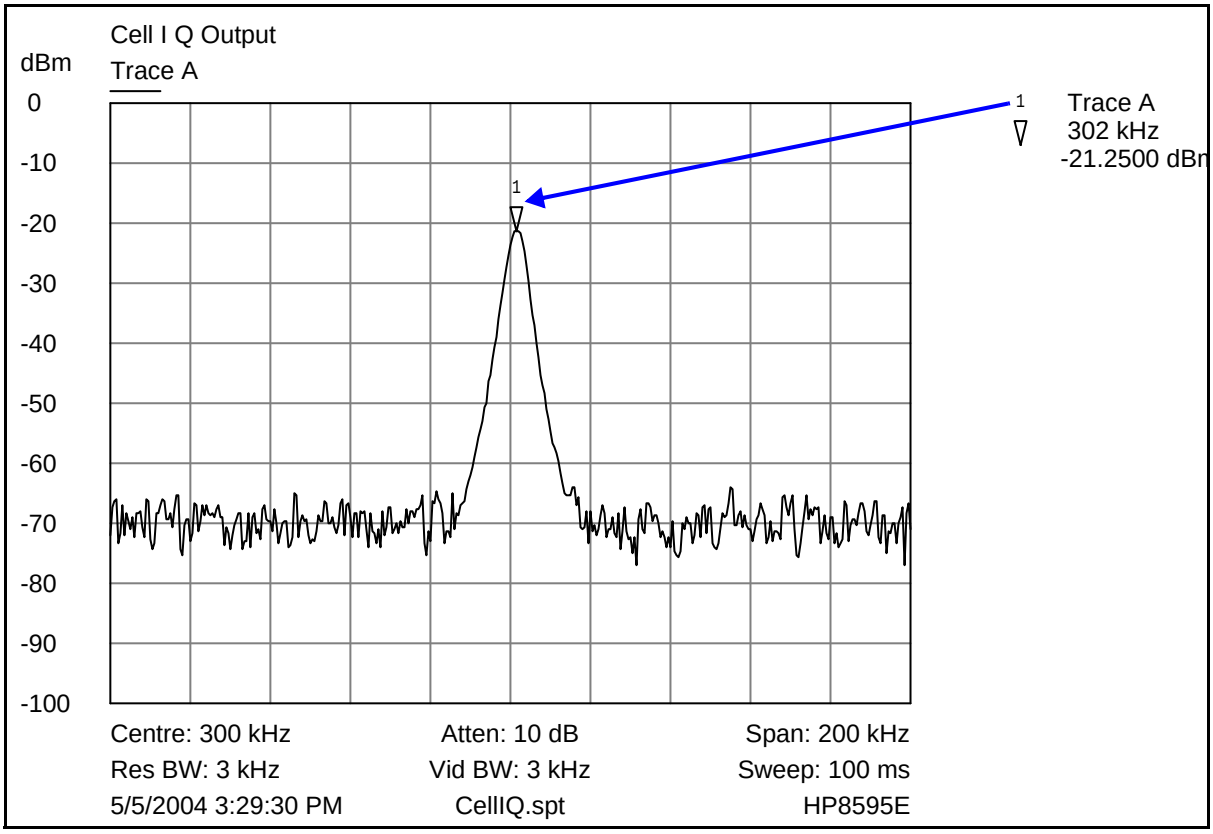

Figure 33: Receiver IQ level on Cell band

Figure 34 shows the Cell spectrum and the test points located on the top side of the main PWB. All four test points should be approximately equal. *WARNING: Direct current is present on these test points.*

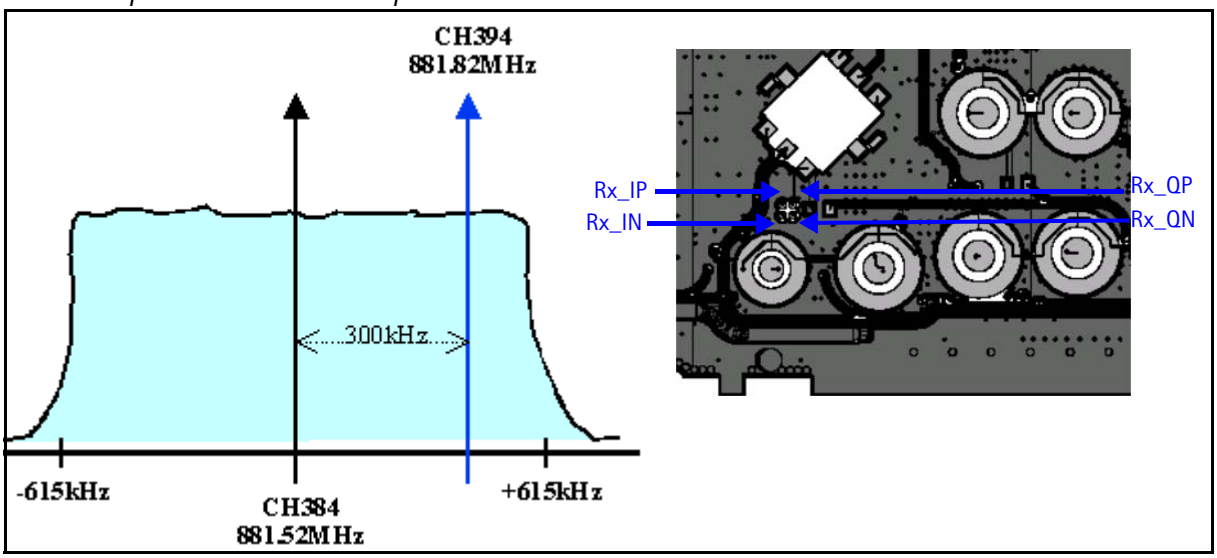

Figure 34: Cell spectrum and test points on the top side of the main PWB

Checking PCS Receiver from RF to IQ

Use the following values to check the PCS receiver functionality from RF to IQ output.

1. Start Phoenix in Local Mode with only the Rx path turned on.
2. Inject a –75dBm CW signal of 1960.5MHz (i.e. 500kHz offset from 1960MHz or 10 channels away).
3. Measure a 500kHz tone on the analyzer. (If a 300kHz tone works but a 500kHz tone does not, the problem is in the BB filter, possibly not set by Phoenix.) You should see a typical -22dBm IQ tone for CDMA PCS.

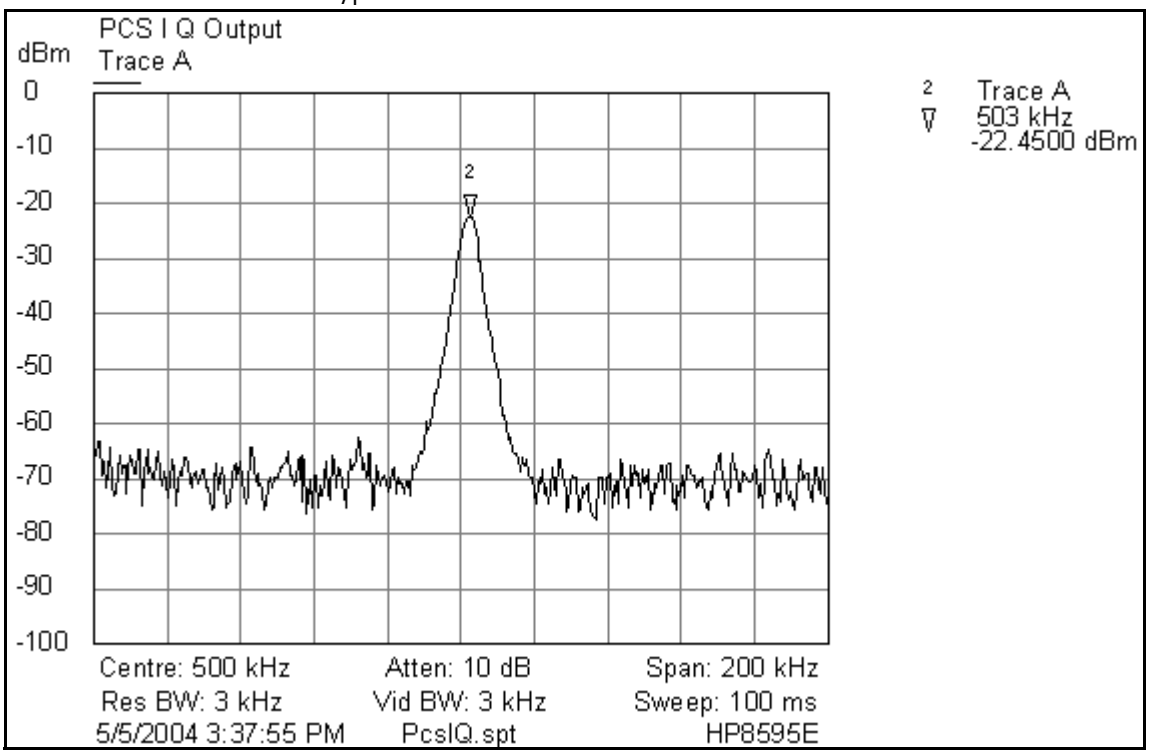

Figure 35: Receiver IQ Level on PCS Band

Figure 35 shows the PCS spectrum and the test points located on the top side of the main PWB. All four test points should be approximately equal. *WARNING: Direct current is present on these test points.*

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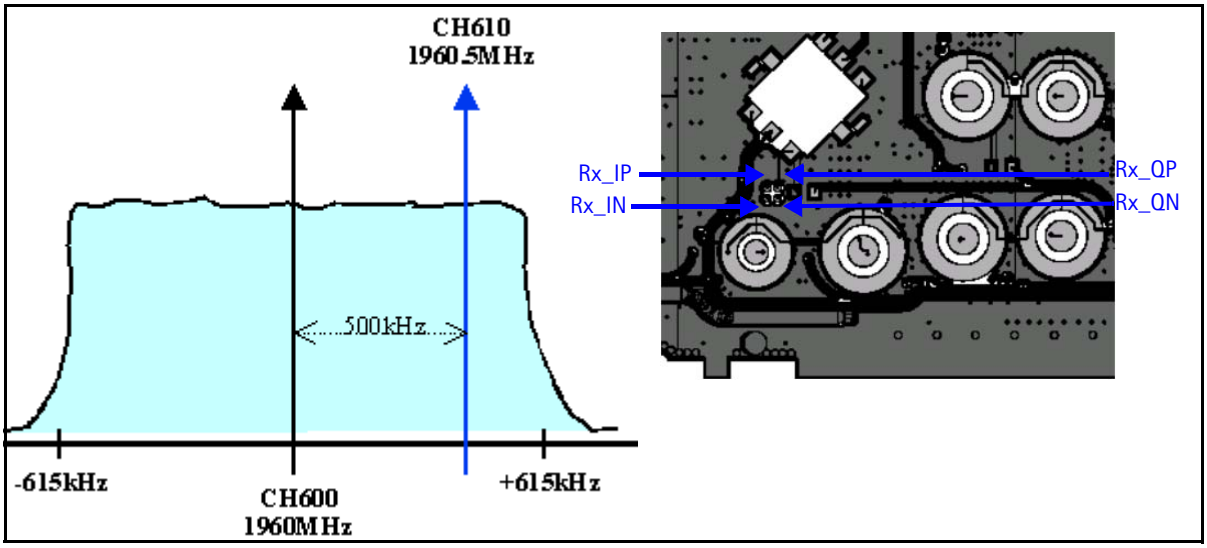

Figure 36: PCS spectrum and the test points on the top side of the main PWB

Receiver Diagnostic Signal Tracing

Use the following steps to trace the receiver signal.

1. Inject an external signal source of –25dBm to the RF input. An Agilent call box 8960 is recommended.
2. Press the Call Setup button, press the Active Cell soft button, and select CW.
3. Inject a CW signal for PCS (1960MHz) or Cell/AMPS (881.52MHz) at a fixed -25dBm power level.
4. Use an AAS-10 probe to take measurements. Signal levels are approximate, and accuracy may be +/- 2dB or more depending on the position and grounding of the probe.

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Receiver DC Test Points

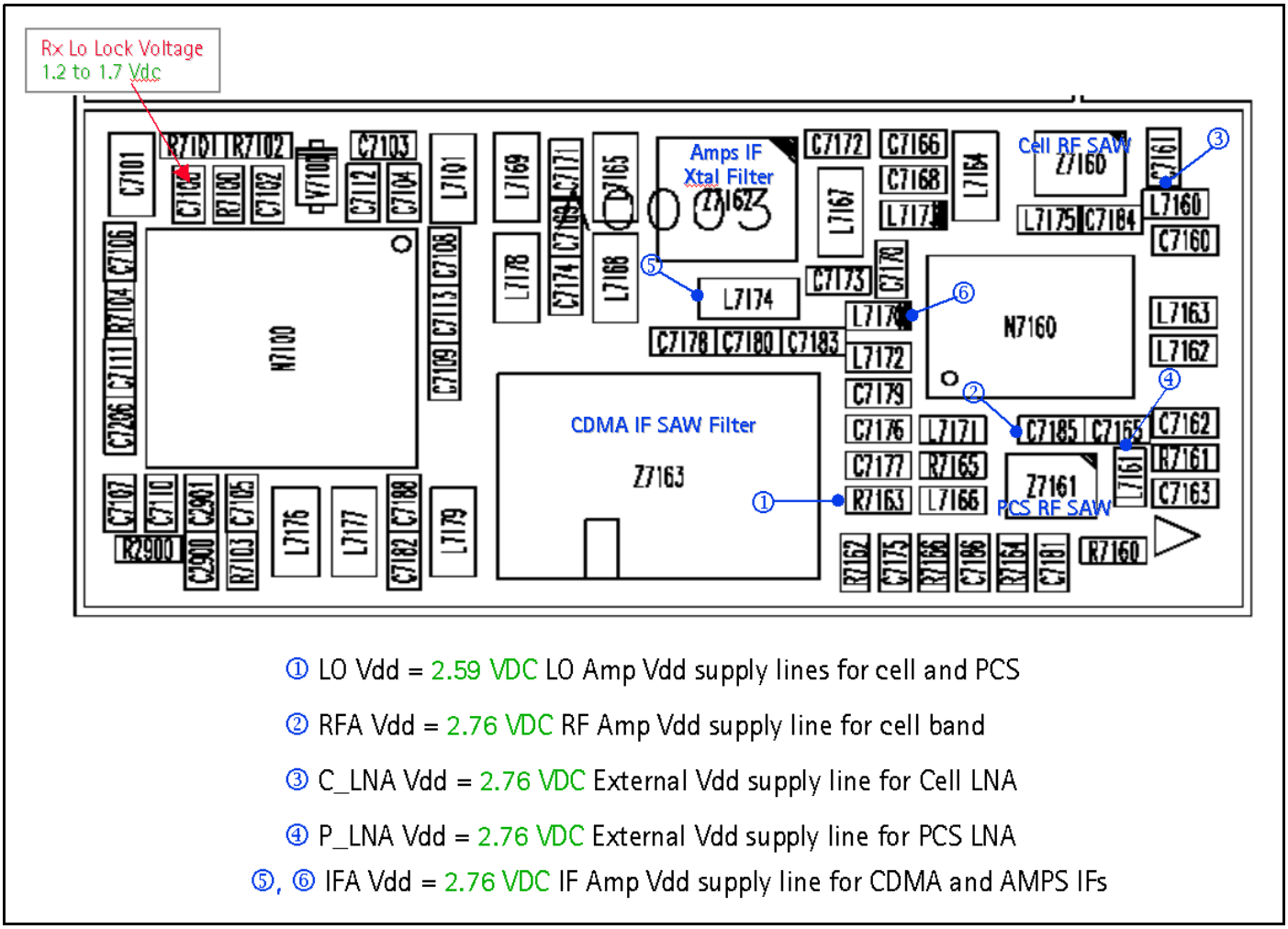
Rx Lo Lock Voltage
1.2 to 1.7 Vdc
Amps IF
Xtal Filter
Z7162
Cell RF SAW
Z7160
N7100
N7160
CDMA IF SAW Filter
Z7163
Z7161
PCS RF SAW
① LO Vdd = 2.59 VDC LO Amp Vdd supply lines for cell and PCS
② RFA Vdd = 2.76 VDC RF Amp Vdd supply line for cell band
③ C_LNA Vdd = 2.76 VDC External Vdd supply line for Cell LNA
④ P_LNA Vdd = 2.76 VDC External Vdd supply line for PCS LNA
⑤, ⑥ IFA Vdd = 2.76 VDC IF Amp Vdd supply line for CDMA and AMPS IFs

Figure 37: Receiver DC troubleshooting test points on the bottom side of the main PWB

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Receiver RF Test Points

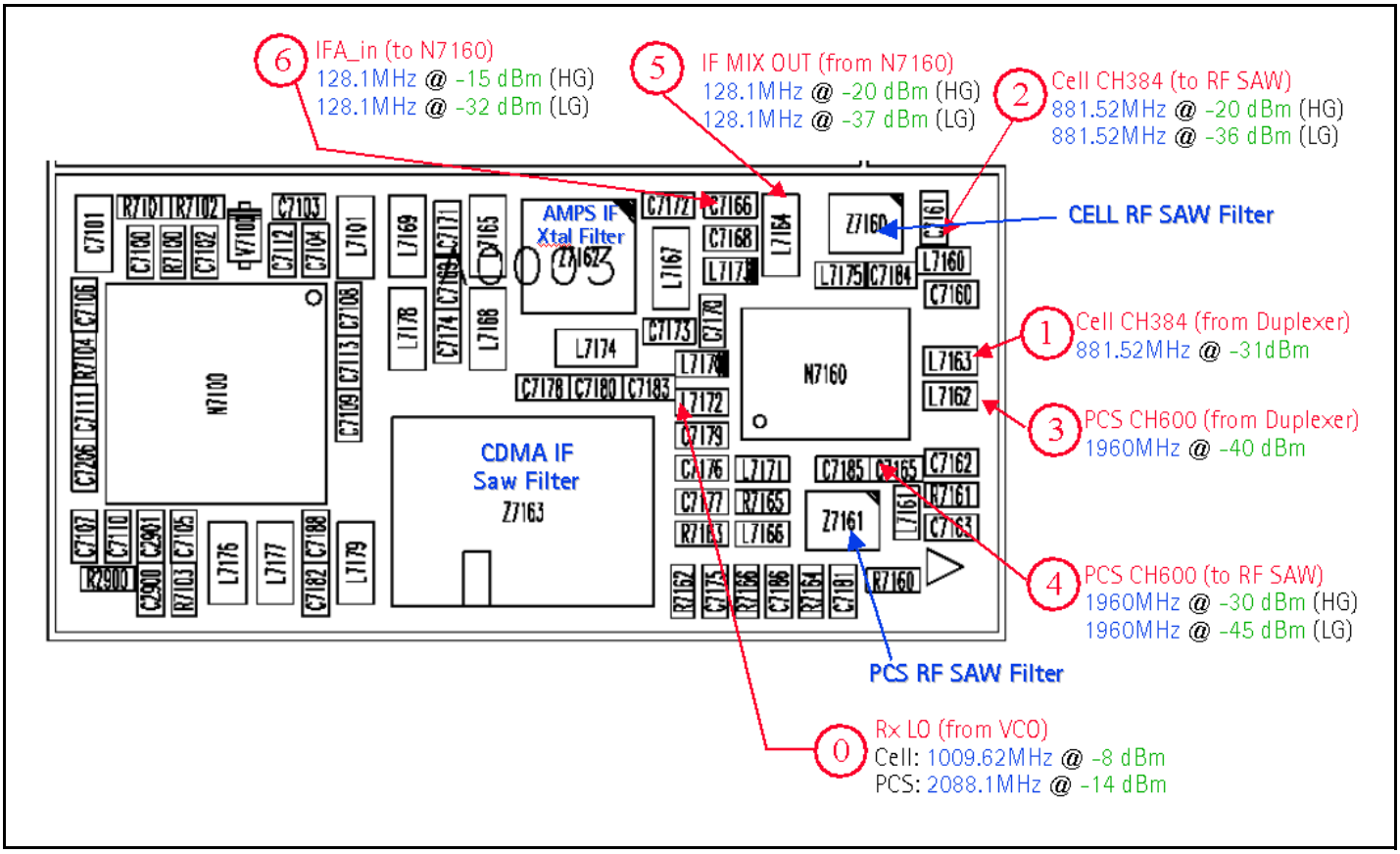

Figure 38: Rx RF test points on the bottom side of the main PWB

Receiver IF Test Points

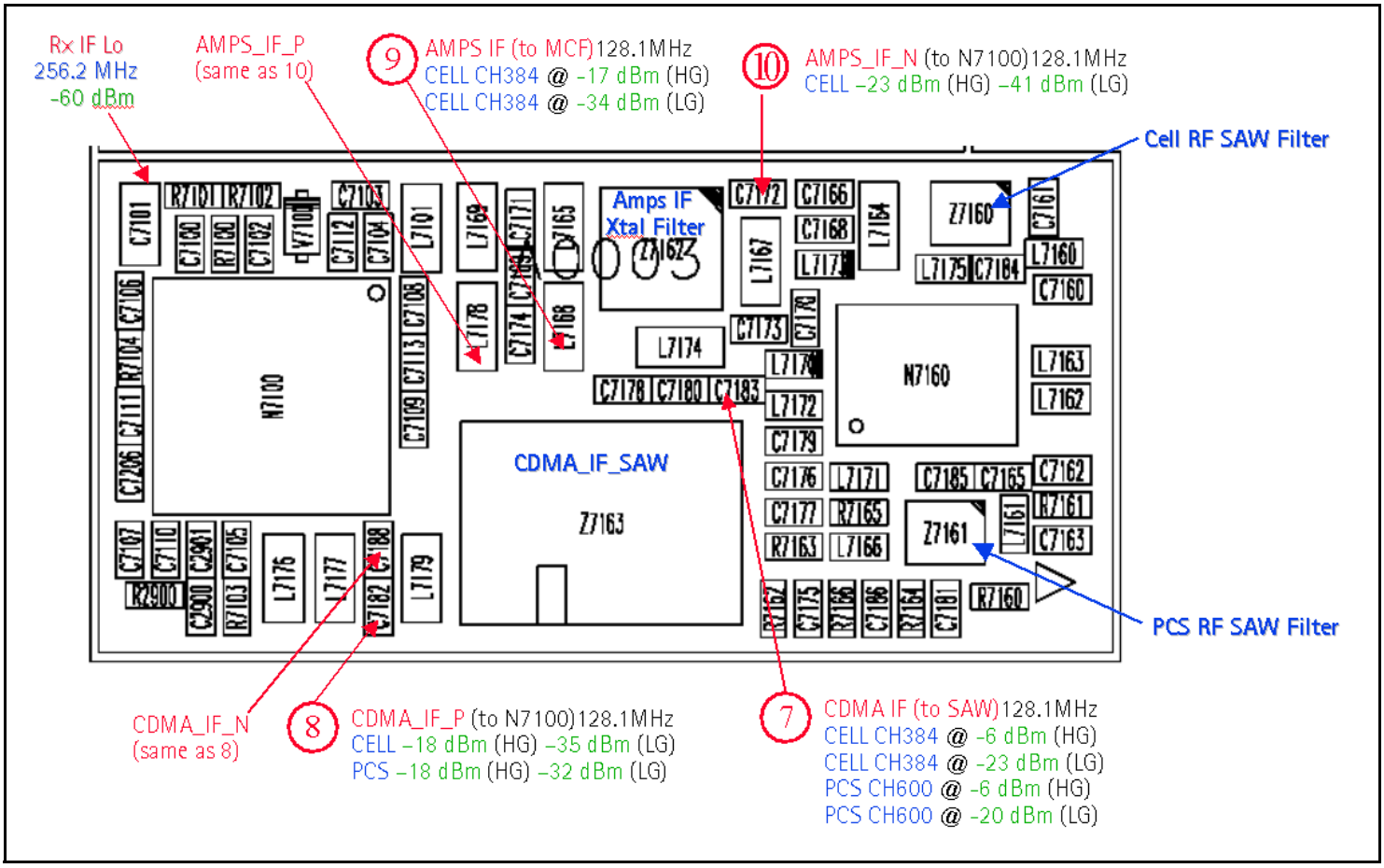

Figure 39: Receiver IF test points on the bottom side of the main PWB

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Receiver Logic Input Voltages

Figure 40 shows the receiver logic input voltages.

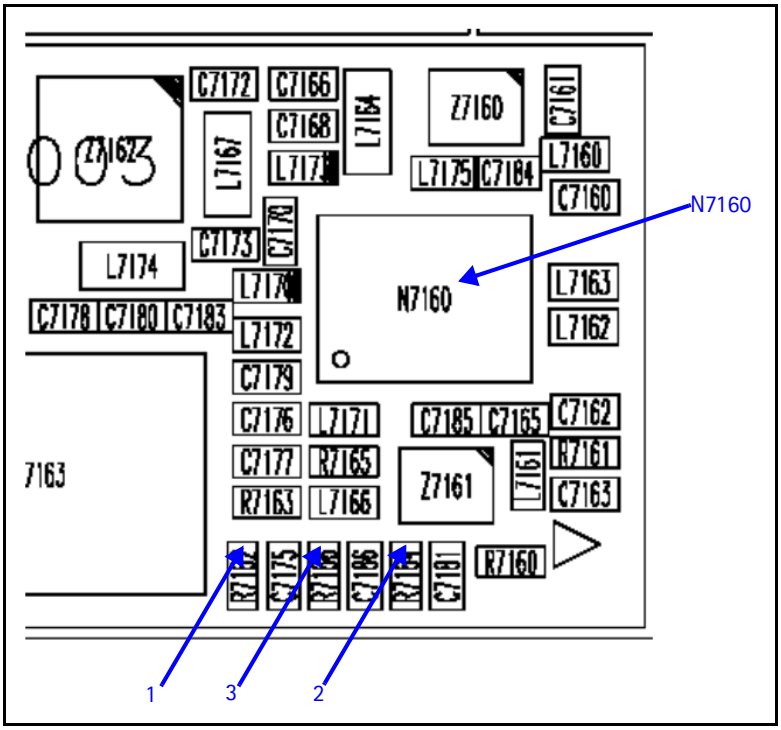

Figure 40: Receiver logic input voltage test points

Table 5 includes the measure logic levels for the N7160.

Table 5: Rx Front-end (N7160) Logic Levels

Mode	Logic Input Voltages		
	IF_SEL	BAND	GAIN_CTL
AMPS High Gain	2.8 V	0.1 V	2.8 V
AMPS Low Gain	2.8 V	0.1 V	0 V
Cell CDMA High Gain	0 V	0.1 V	2.8 V
Cell CDMA Low Gain	0 V	0.1 V	0 V
PCS CDMA High Gain	0 V	2.7 V	2.8 V
PCS CDMA Low Gain	0 V	2.7 V	0 V

If the logic levels are significantly off (+/- 0.2V), replace the N7160 and re-measure. If the voltages are still out of specifications, refer to the *Baseband Troubleshooting* chapter.

N7160 Receiver Overview

Keep the following points in mind regarding the N7160 receiver:

- There is a separate LNA for 800MHz (Cell and AMPS) and 1900MHz (PCS).
- There is a separate RFA (inside N7160) for 800MHz (Cell and AMPS) and

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1900MHz (PCS).

- After the RFA, there is a mixer, and then the signals are separated by CDMA (Cell and PCS) and AMPS.

  For example, if there is no IF frequency (128.1MHz) check both Cell and PCS. If only one has 128.1MHz at L753, ensure that IF_SEL is working. If it is, then replace the N750 due to a bad RFA.

  If Cell and AMPS are working but PCS is not, look at the band select line and the PCS LNA before replacing the N7160.

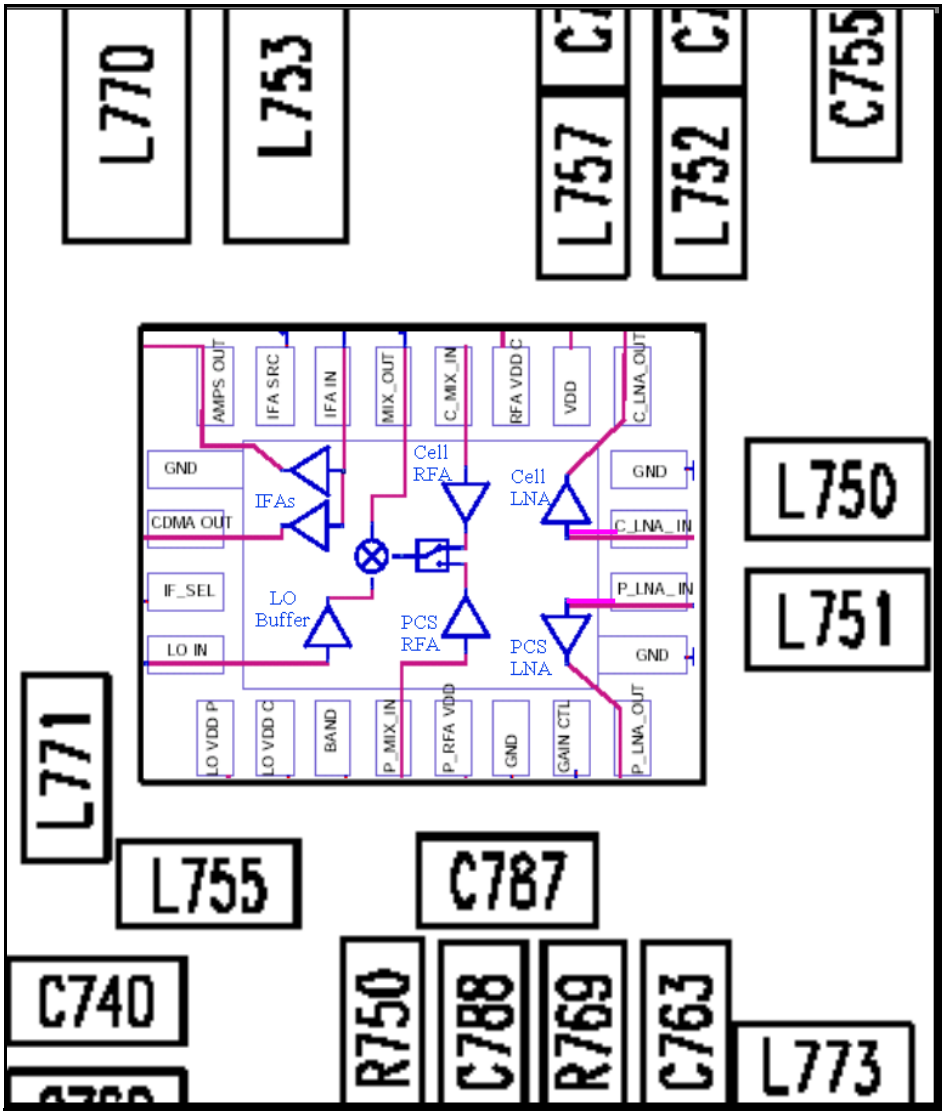

Figure 41: N7160 receiver

There are two common explanations for an N7160 failure consisting of high current in Local Mode with just the Rx turned on:

- No presence of an LO signal
- Input impedance drop is shorting out one of the DC supply pins to the chip

IMPORTANT: You must check for both conditions before replacing the chip. If you have no LO signal, refer to "UHF Synthesizer Troubleshooting" on page 52. If you have a significant supply voltage drop on one of the supply pins, then replace the N7160.

Table 6: N7160 Conditions and Supply Currents

Condition: Local Mode, Set Rx Only in RF Main Mode	Supply Current (From Power Supply)
Good mobile terminal	100mA
No UHF LO signal present	254mA
Pin 13 shorted	255mA

Synthesizer Troubleshooting

Faulty synthesizers can cause both Rx and Tx failures during tuning, in addition to the VCTCXO tuning. However, first check for the presence of various LO signals and their proper levels. If everything fails, it may be necessary to check the reference clock (19.2MHz) which is needed for the mobile terminal to power up. The 19.2MHz signal is also important because the D2800 processor is sensitive enough to pick up a very weak 19.2MHz clock, resulting in intermittent problems such as a constant mobile terminal reset.

Following are the synthesizers used in the mobile terminal:

- Dual-band UHF (1009.62MHz for channel 384 in Cell and AMPS bands, and 2088.1MHz for channel 600 in PCS band) with a separate LMX2310 PLL IC
- Rx VHF (256.2MHz for Cell, AMPS, and PCS) with PLL inside the N7100 IC
- Tx UHF (3296.16MHz~3395.88 for Cell and AMPS, 3700~3819.9MHz for PCS) with PLL inside the N7000 IC

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Synthesizer Block Diagram

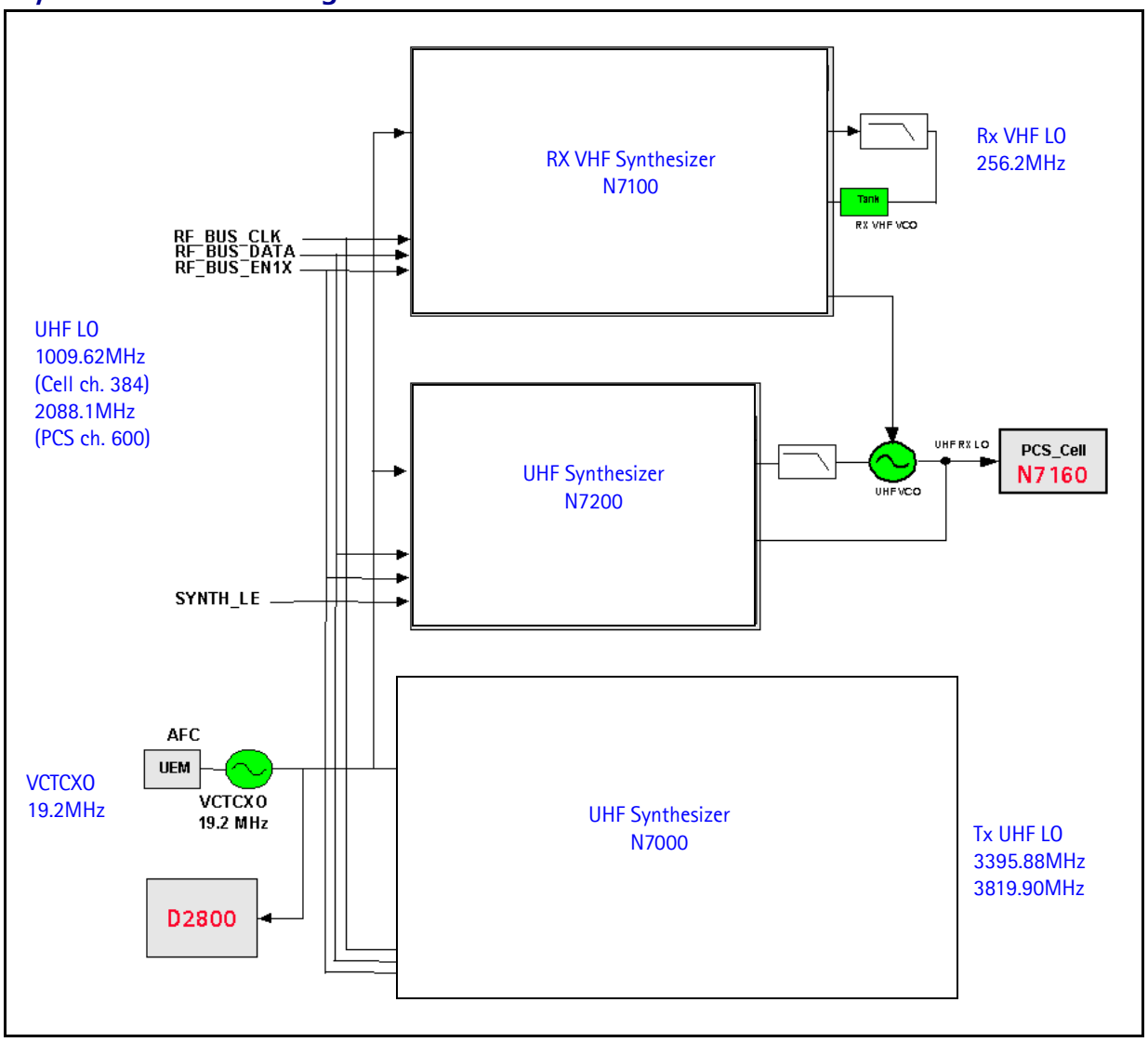

Figure 42: Synthesizer block diagram

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Synthesizer Schematics

The following schematics are for general reference only. See the *Schematics* chapter for detailed versions.

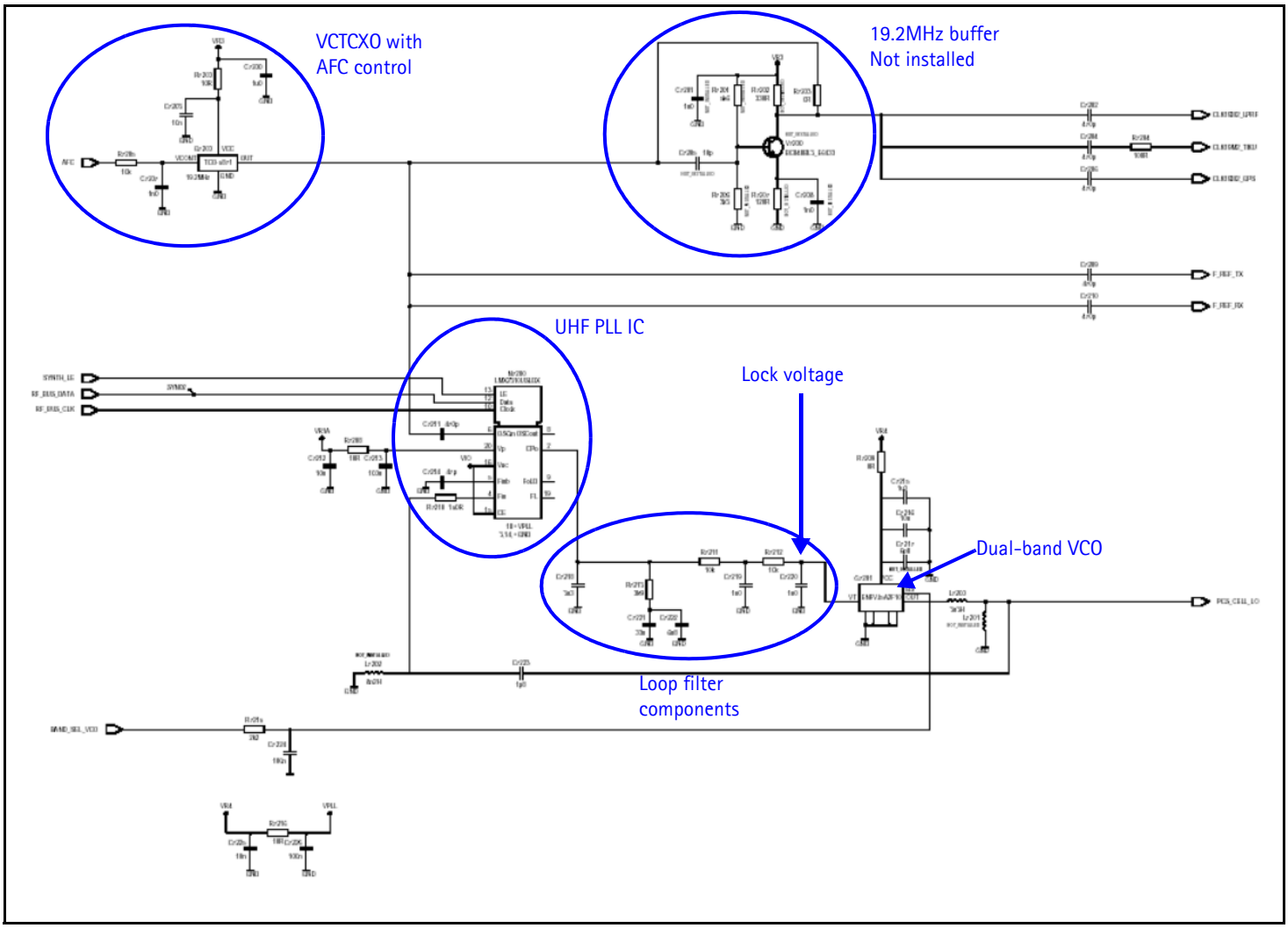

Figure 43: Synthesizer schematic

Synthesizer Troubleshooting Setup

Use the following steps to troubleshoot the synthesizer using Phoenix:

1. On the **Phone Control** dialog box, click the **LOCAL** button in the **Phone State** area to put the mobile terminal into Local Mode.

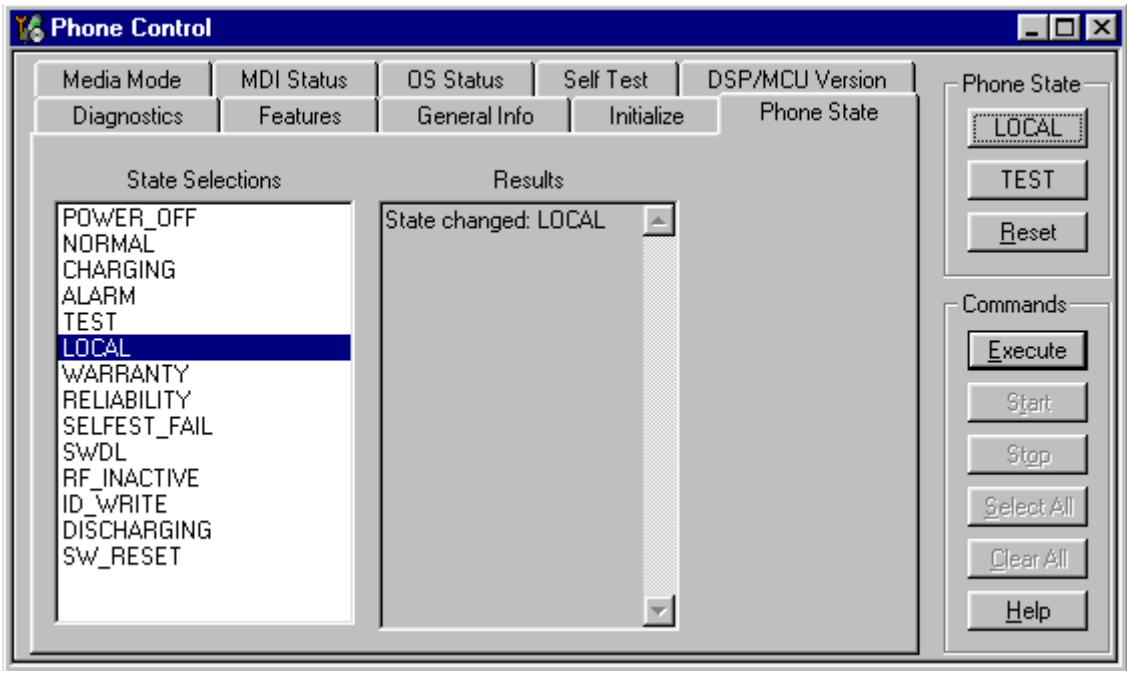

Figure 44: Phone Control dialog box

2. Select the following values on the **RF Main Mode** dialog box:.

Table 7: RF Main Mode Dialog Box Settings

Synthesizer	Band	Mode	Channel
UHF	Cell	Rx/Tx	384
	PCS	Rx/Tx	600
Rx VHF	(one band is enough)	Rx	
Tx VHF	Cell	Rx/Tx	384
	PCS	Rx/Tx	600

Top Level Troubleshooting

Check for the folowing problems during your initial troubleshooting:

- Faulty synthesizers can cause both RX and TX failures during tuning, in addition to the VCTCXO tuning.
- With AMS phones, it is recommended first to check for the presence of various LO's signals and their proper levels.
- The reference clock, 19.2MHz, is needed for the phone to power up. Therefore, if everything fails, perhaps it may be necessary to check the presence of 19.2MHz.

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The level of 19.2MHz is also important because the D2800 is very sensitive and can pick up a weak 19.2MHz clock. This can result in intermittent problems, such as constant phone reset.

- The synthesizers for 6235/6235i/6236i are:

Table 8: Synthesizers for 6235/6235i/6236i

Synthesizer	Band	Channel	PLL
Dual Band UHF	Cell and AMPS	1009.62 MHz at CH384	separate LMX2310 PLL IC
	PCS	2088.10 MHz at CH600	
Rx VHF	Cell, AMPS and PCS	256.2 MHz	inside N7100 IC
Tx UHF	Cell and AMPS	3298.16~3395.88 MHz	inside N7000 IC
	PCS	3700.00~3819.90 MHz	

Incorrect PLL Frequencies

Following are some possible causes for incorrect PLL frequencies:

- Power supplies to PLL portion
- Control line to VCO
- Loop filter or resonator components missing or incorrectly installed
- 19.2MHz reference clock missing or low
- Component failure (PLL IC, N7100, N7000, VCO, or VCTCXO)

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VCTCXO Troubleshooting

Without 19.2MHz, the mobile terminal does not power up. This signal goes to the N7100, N7000, D2800, and the UHF PLL. Check the test points in Figure 45 for the presence of the 19.2MHz signal.

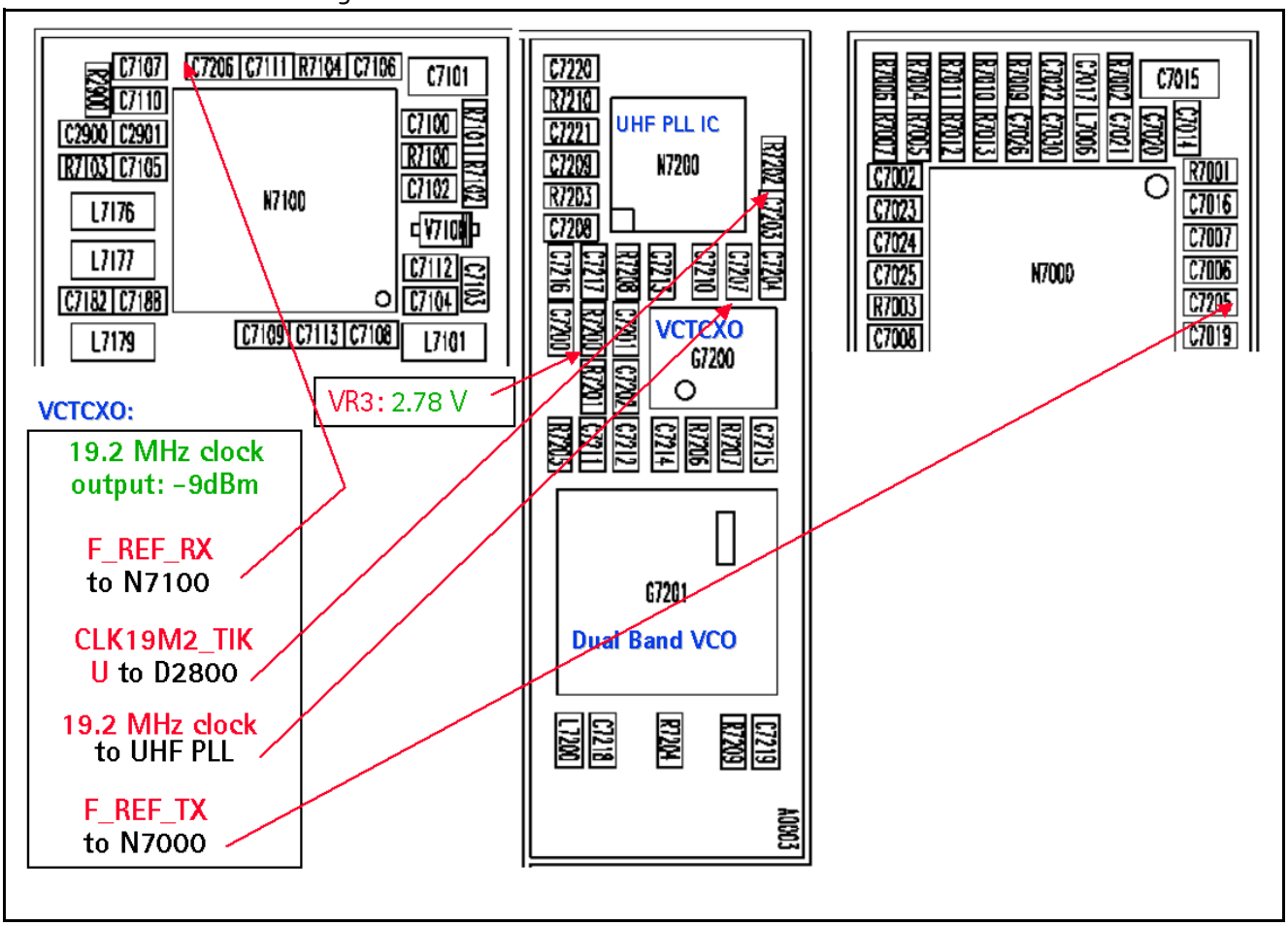

Figure 45: VCTCXO test point output values

If you do not see the VCTCXO signal at any of these points, check voltage at VR3, main supply line for VCTCXO, it should be 2.78VDC.

Also check the AFC voltage, it should be between 1 and 3 volts. The voltage should be adjustable with the AFC slider on the RF PDM Control in Phoenix. See "AFC Voltage Troubleshooting" on page 49. If AFC voltage is missing, check the UEM.

VCTCXO Manual Tuning

The VCTCXO can be manually tuned to verify when a mobile terminal is tuned incorrectly or if mobile terminal cannot make a call. Monitor the RF signal at the mobile terminal's output.

1. On the **Phone Control** dialog box, click the **LOCAL** button in the **Phone State** area to put the mobile terminal into Local Mode. (See Figure 7 on page 11 for an example of the **Phone Control** dialog box.)
2. Click the **Execute** button.

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3. On the **AMPS Control** dialog box, set the **Set Channel** field to 384, the **Power Level** field to 5, and select the **Transmitter ON** check box. (See Figure 8 on page 12 for an example of the **AMPS Control** dialog box.)
4. Click the **Rx RFI** tab, make sure the **AFC Control** check box is cleared, and click **Execute**.
5. The frequency accuracy of the VCTCXO can be measured using an HP8960 callbox in AMPS mode or a spectrum analyzer at the output of the transmit chain.
   - If using a spectrum analyzer, set the center frequency to 836.52MHz and the span to 2MHz initially. Establish a marker at 836.52Mhz.
   - If using an HP8960, set the callbox System Type to AMPS, and set the ACC channel to 384. Use the Frequency Stability measurement to center the VCTCXO (minimum Frequency Error).
6. Use the RF PDM component to adjust the AFC to center the VCTCXO. The tuning range is approximately +/-10kHz.
7. Adjust the AFC so that the output signal is within +/-150MHz. If using a spectrum analyzer, narrow the span to 1kHz or less.
8. Replace the UEM if the VCTCXO does not tune correctly.

AFC Voltage Troubleshooting

Use the following steps to monitor the AFC voltage.

1. In Phoenix, open the **RF PDM** dialog box.

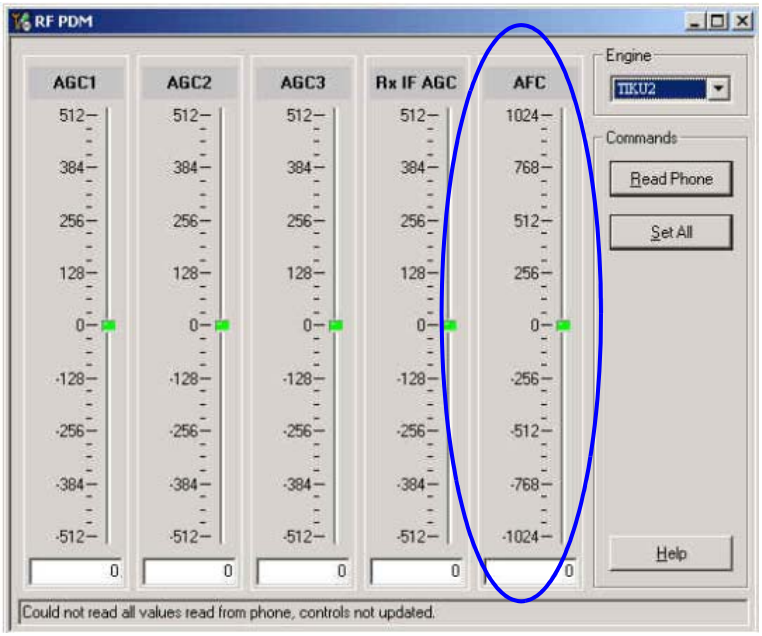

Figure 46: RF PDM dialog box for AFC troubleshooting

Figure 47 shows a partial schematic of the R7201.

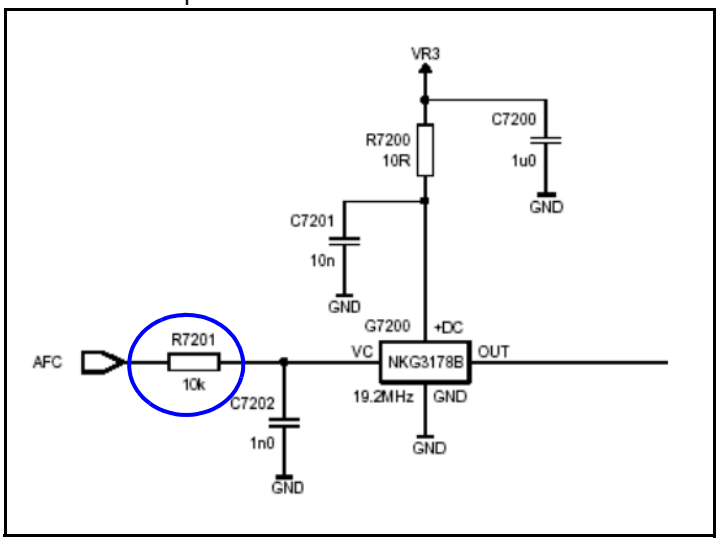

Figure 47: Partial schematic showing the R7201

2. Measure the DC voltage at R7201. The following typical voltages are shown in Figure 48.
   - 1 = AFC PDM[-1024]=0.8V
   - 2 = AFC PDM[0]=1.3V
   - 3 = AFC PDM[1023]=2.5V

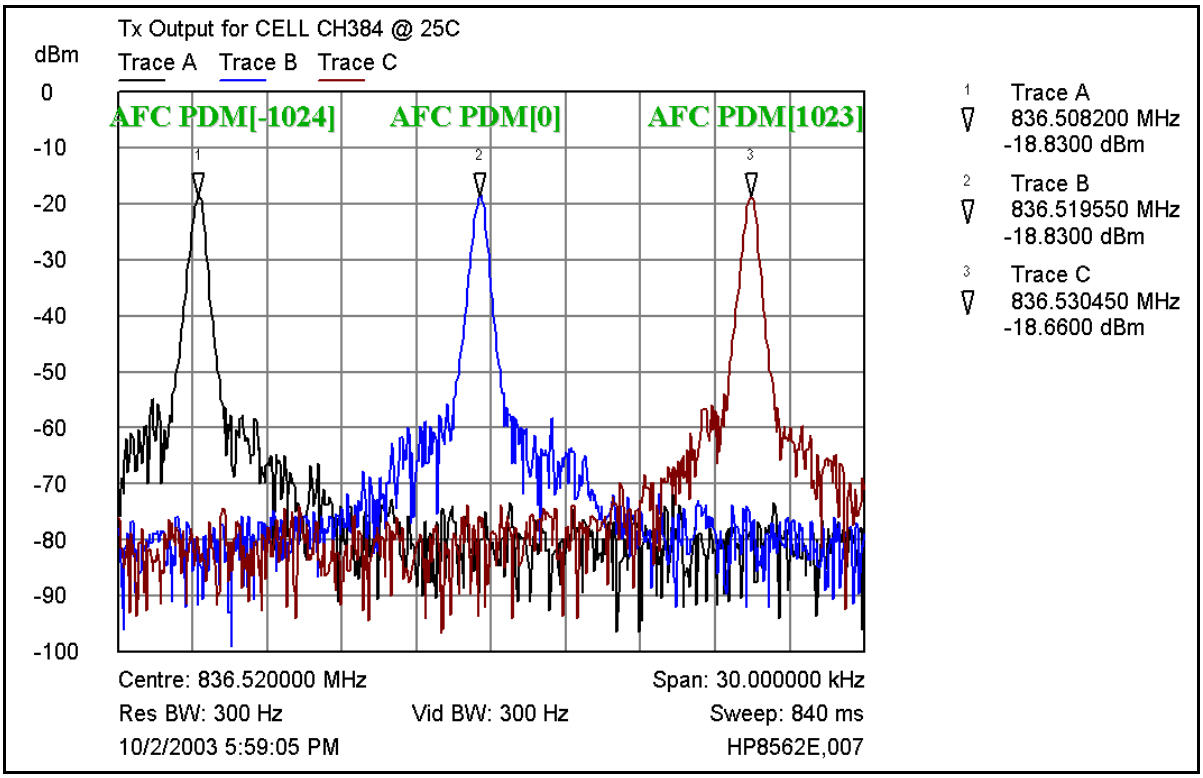

Figure 48: Tx Output for Cell channel 384, power level 5

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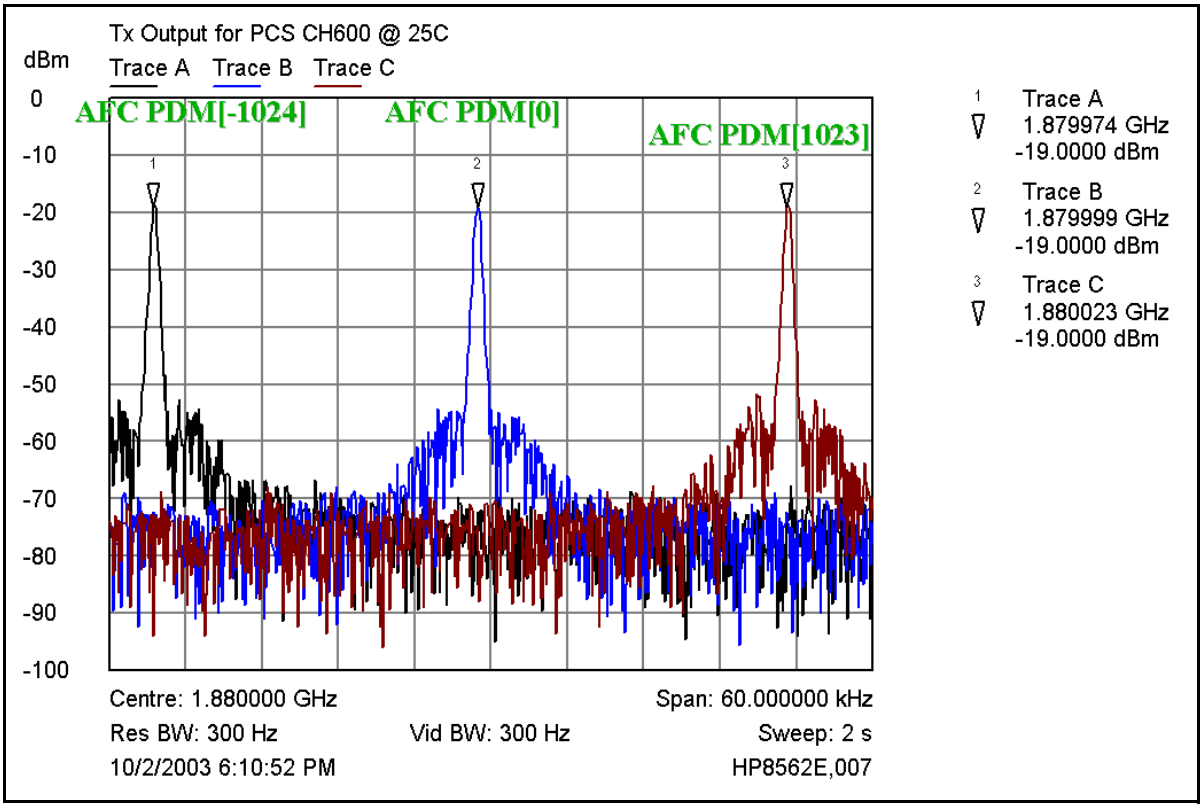

Figure 49: Tx Output for PCS channel 600, power level 5

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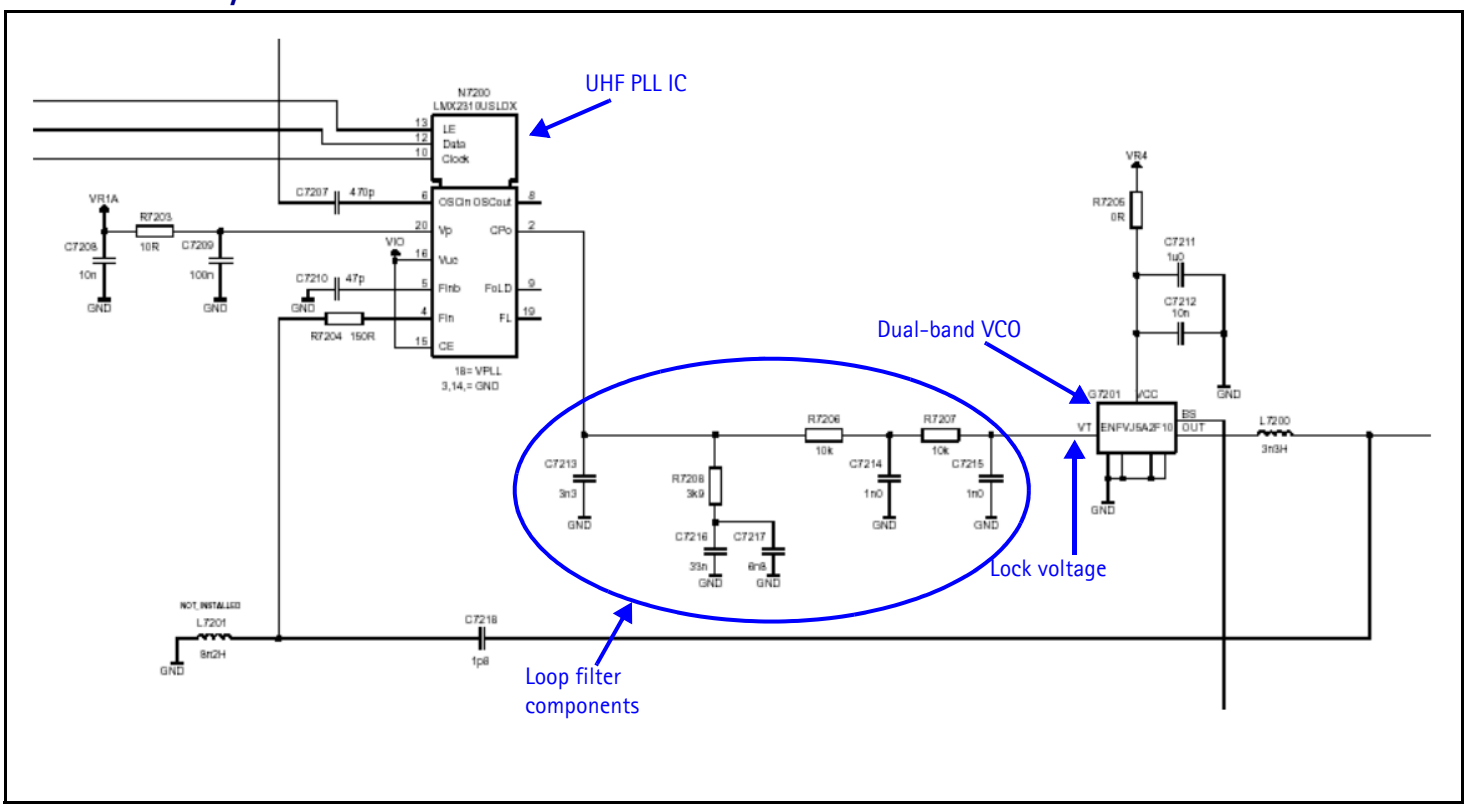
UHF Synthesizer Schematic



UHF Synthesizer Troubleshooting

The UHF LO frequency varies with the channel and can be calculated using the Frequency Calculator dialog box in the Phoenix RF component (see Figure 50 on page 53). Use the following steps to troubleshoot the UHF LO frequency.

1. Ensure that the LO is locked. Set a channel and check the output of the UHF LO at L7200 within a very narrow span of 100KHz. The LO must be virtually immobile.
2. Measure the nominal UHF LO signal levels (see "UHF Synthesizer Test Points" on page 54).
3. If you do not see the presence of any LOs, check the DC voltages at the following:
   - R7203, VR4, supply line for VCO IC and PLL IC = 2.76VDC
4. If the frequency of the LO is not correct, check the DC voltages at the following:
   - R7210, VR1A, supply line for PLL charge pump = 4.76VDC
5. Ensure that the lock voltage at C7215 is between 1V and 3V.
6. Check the RF return at R7204.
   - **TX UHF LO (Cell/AMPS)** = Tx frequency x 4
   - **TX UHF LO (PCS)** = Tx frequency x 2

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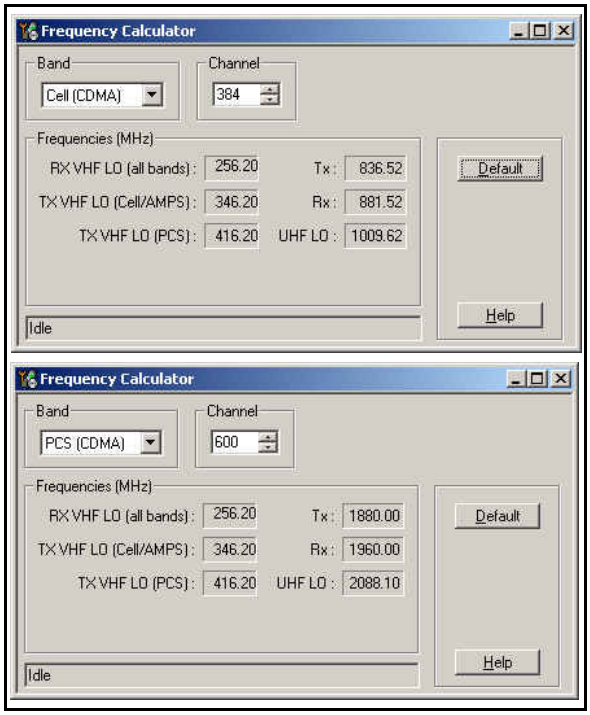

Figure 50: RF Frequency Calculator dialog box

UHF Synthesizer Test Points

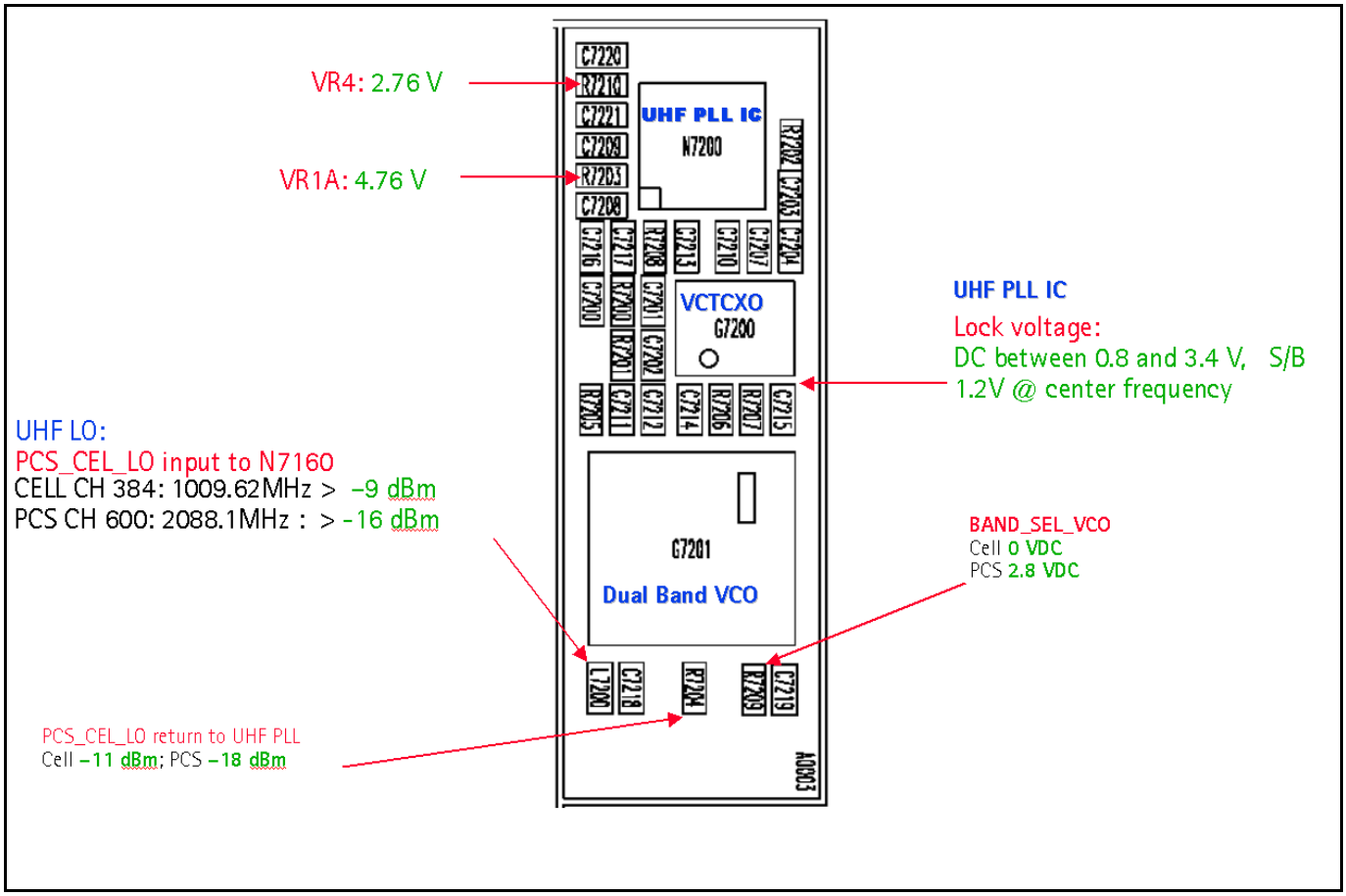

Figure 51: UHF synthesizer layout

Typical UHF LO Spectrum Outputs

When analyzing the specturm ouputs, first measure the purity of the UHF LO, then look at the level offset from the carrier. Also check the VCO, PLL IC, loop filter and power decoupling. The results in Figure 52 and Figure 53 may be difficult to accomplish without a high impedance and high spectrum analyzer.

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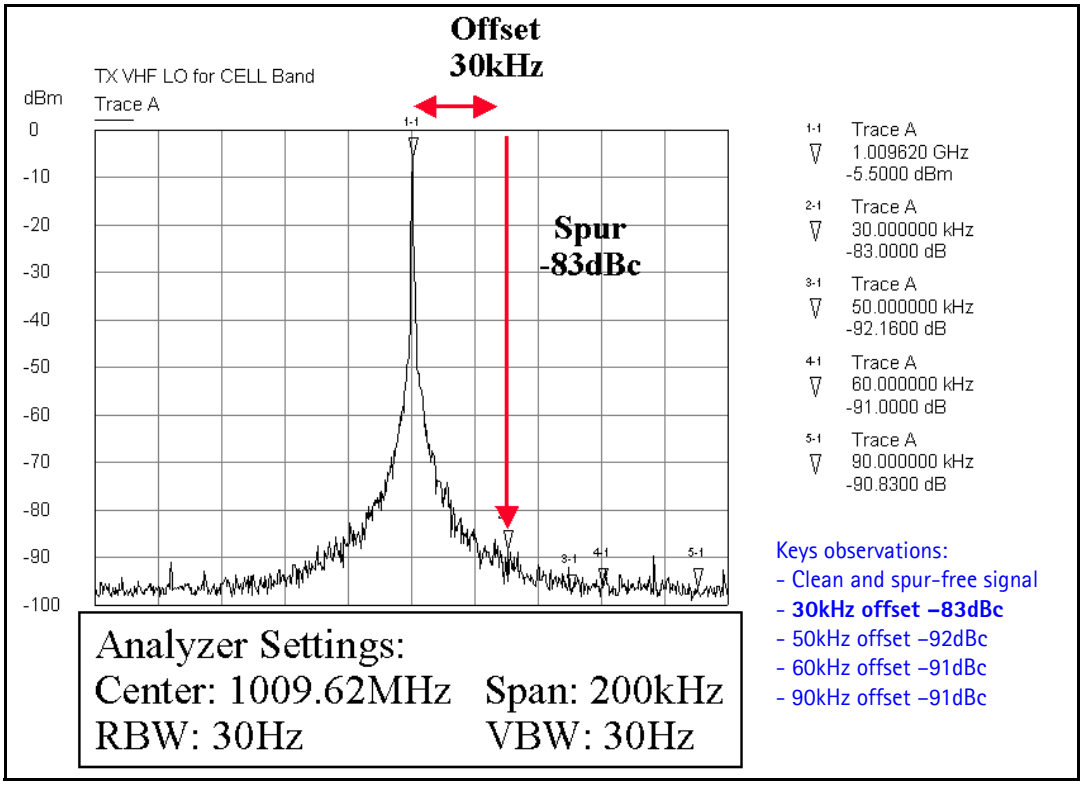

Figure 52: UHF LO Output for Cell channel 384, power level 5

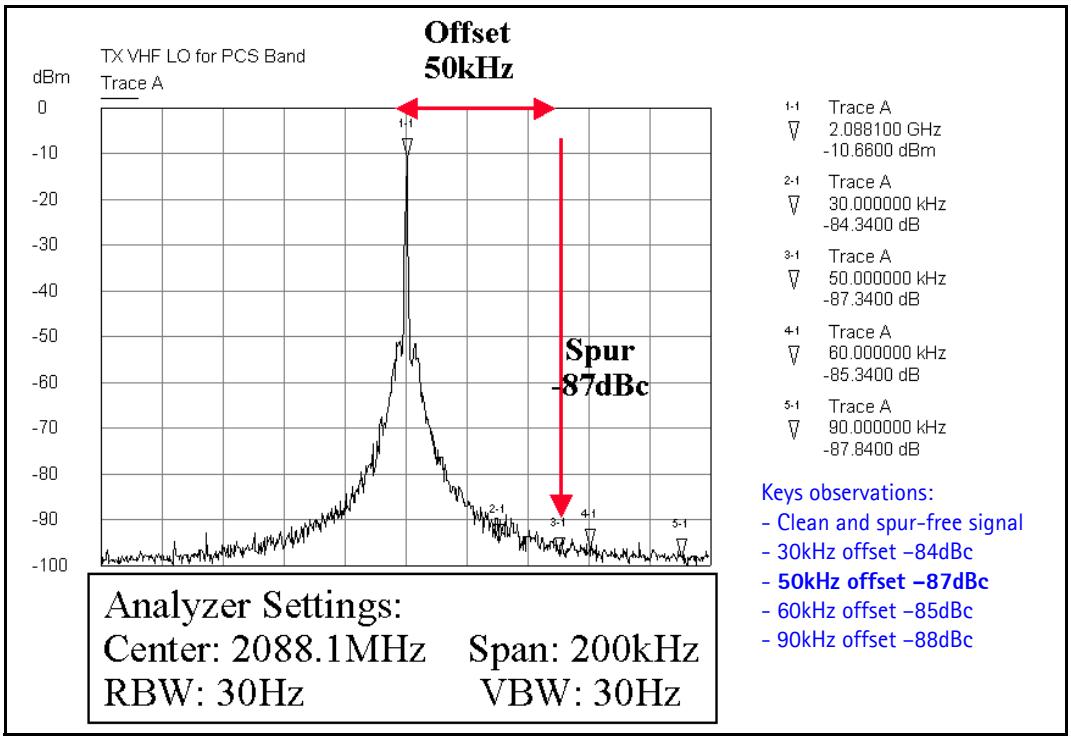

Figure 53: UHF Output for PCS channel 600, power level 5

Rx VHF LO (N7100) Schematic

Following are the main layout components on a partial view of the Rx VHF schematic. See the *Schematics* chapter for detailed versions.

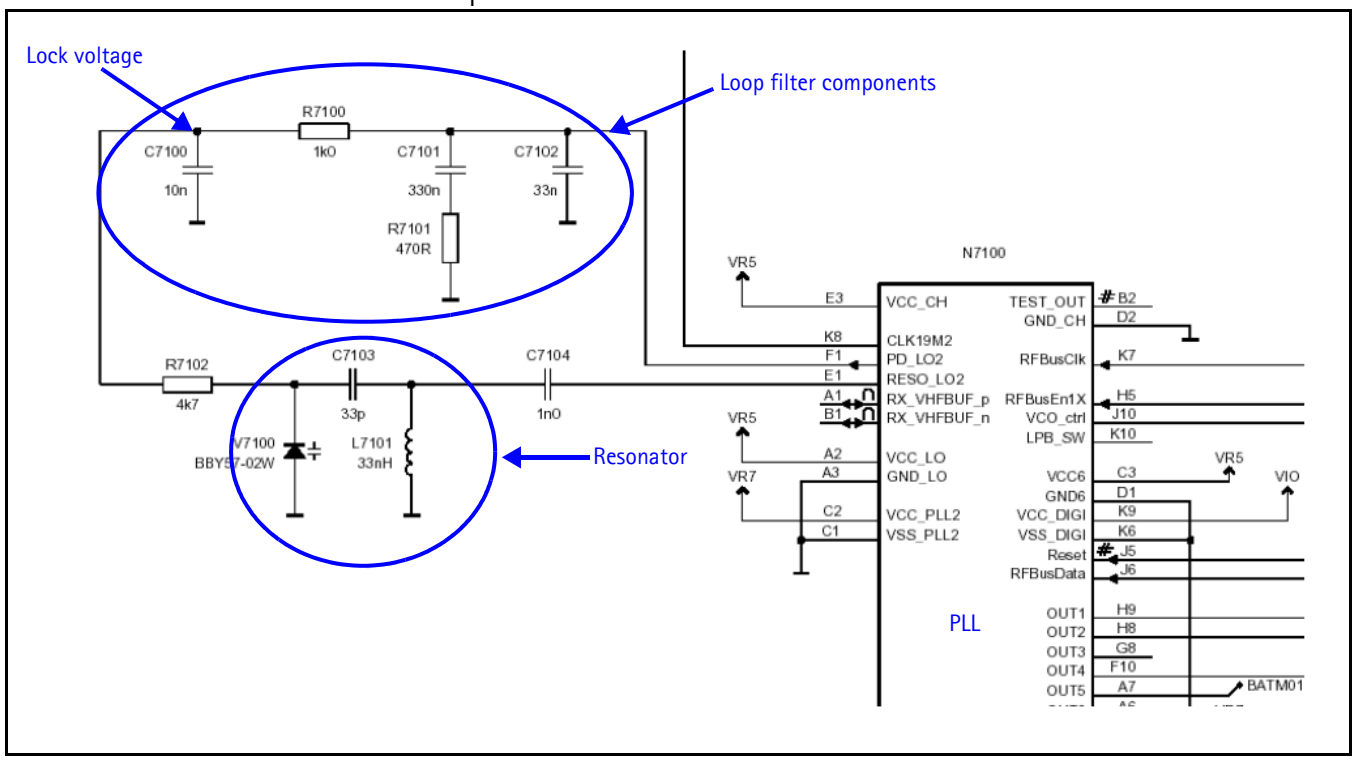

Figure 54: Rx VHF schematic, partial view

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Rx VHF LO Troubleshooting

The VHF LO operates at a fixed frequency of 256.2MHz. It is the second LO for down-conversion to I and Q for baseband processing. Use the following steps to troubleshoot the VHF LO.

1. Monitor the test point at C7100. Ensure that a locked and stable 256.2MHz with amplitude ~ –60dBm is present on the spectrum analyzer (or, with a high impedance probe, ~ -2dBm at C7104).
2. Monitor the control voltage at C7100. The control voltage at a locked state must be between 1.2 and 1.7 Vdc for the proper operation of the VHF LO.

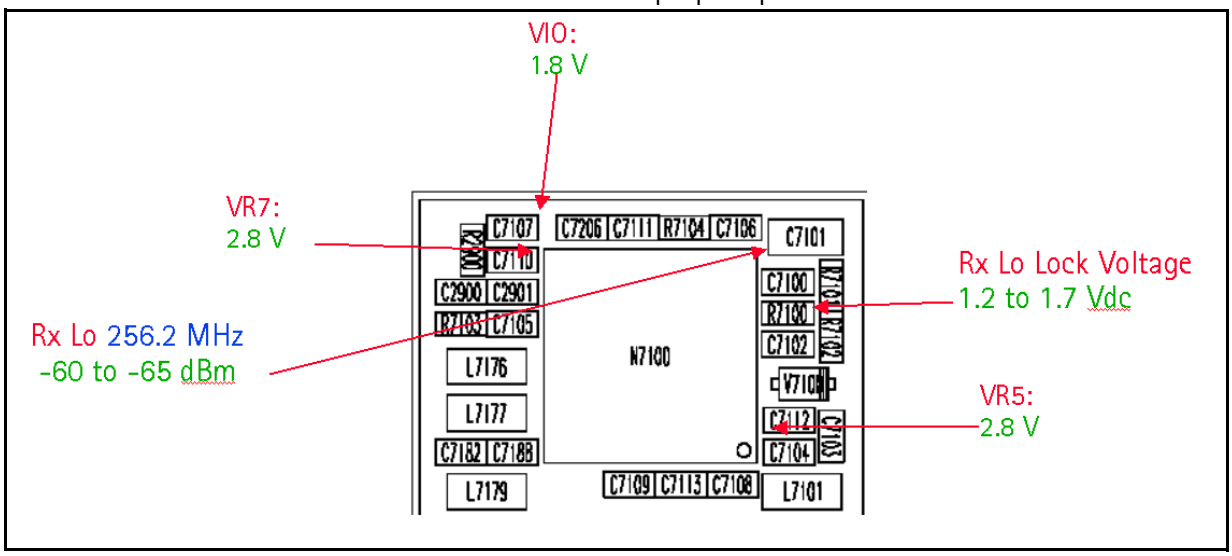

Figure 55: Rx VHF LO test points

Tx UHF LO (N7000) Schematic

The following partial schematic is for general reference only. See the *Schematics* chapter for complete detailed versions.

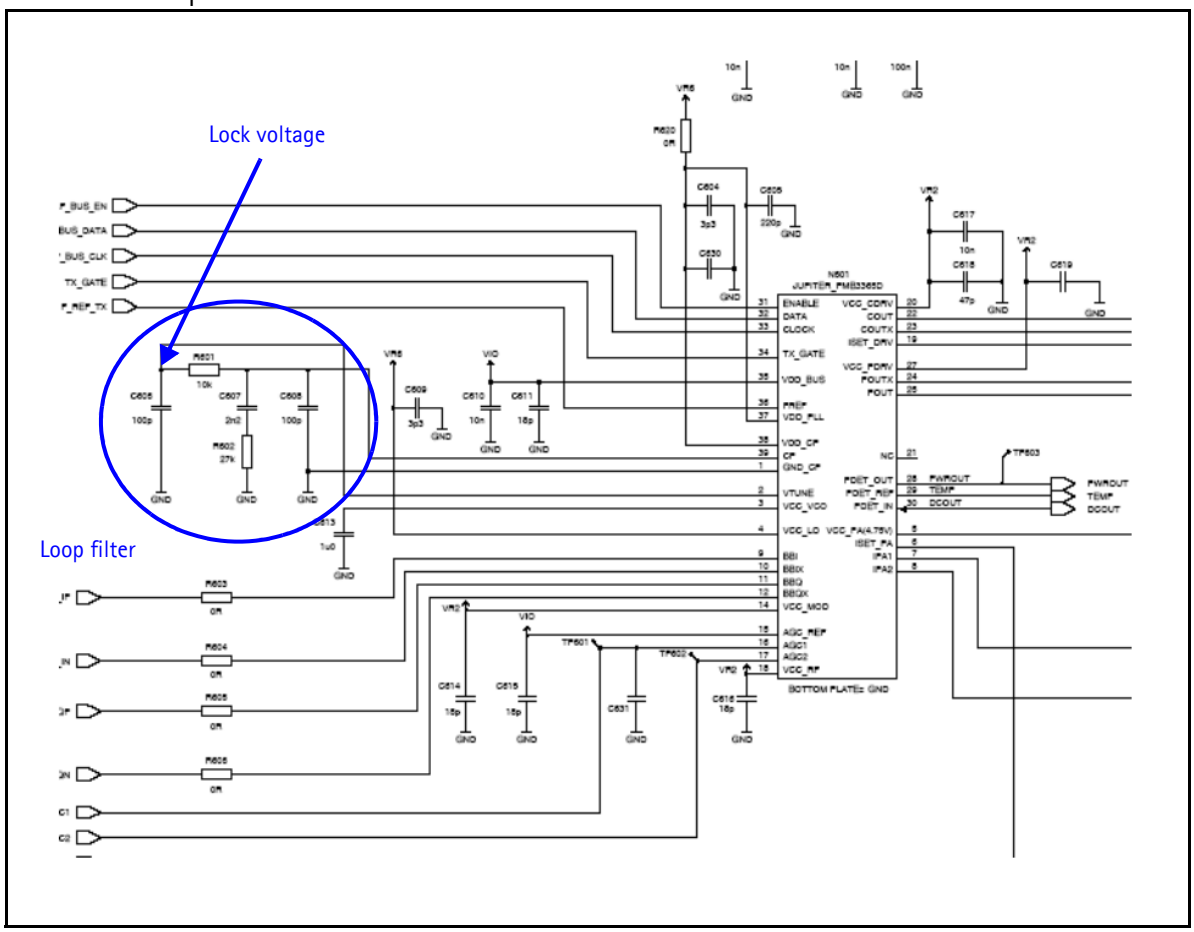

Figure 56: Tx UHF LO (N7000) schematic

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Tx UHF LO (N7000) Troubleshooting

There are two fixed LOs, 3296.16~3395.88MHz for cell band and 3700~3819.90MHz for PCS band. This is the only LO for up-conversion. Be sure to monitor the control voltage at R7001. When the N7000 LO is locked, this control voltage should be between 1.2 and 1.8Vdc.

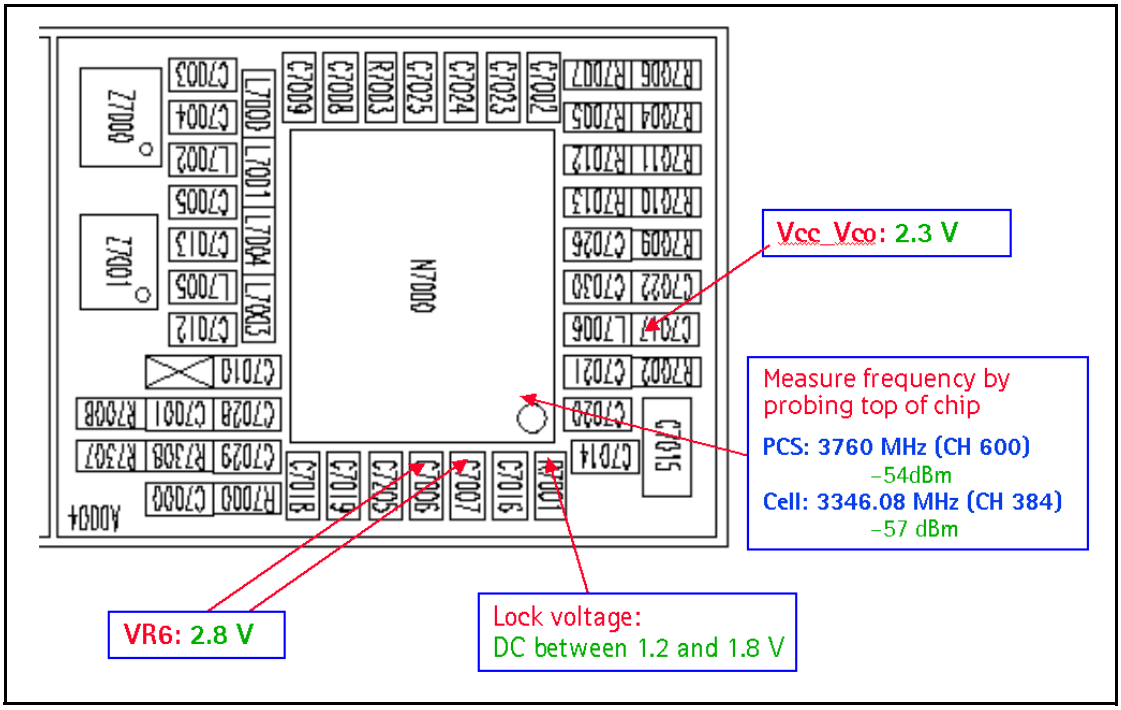

Figure 57: Tx UHF LO layout and test points

Typical Transmitter UHF LO Spectrum Outputs

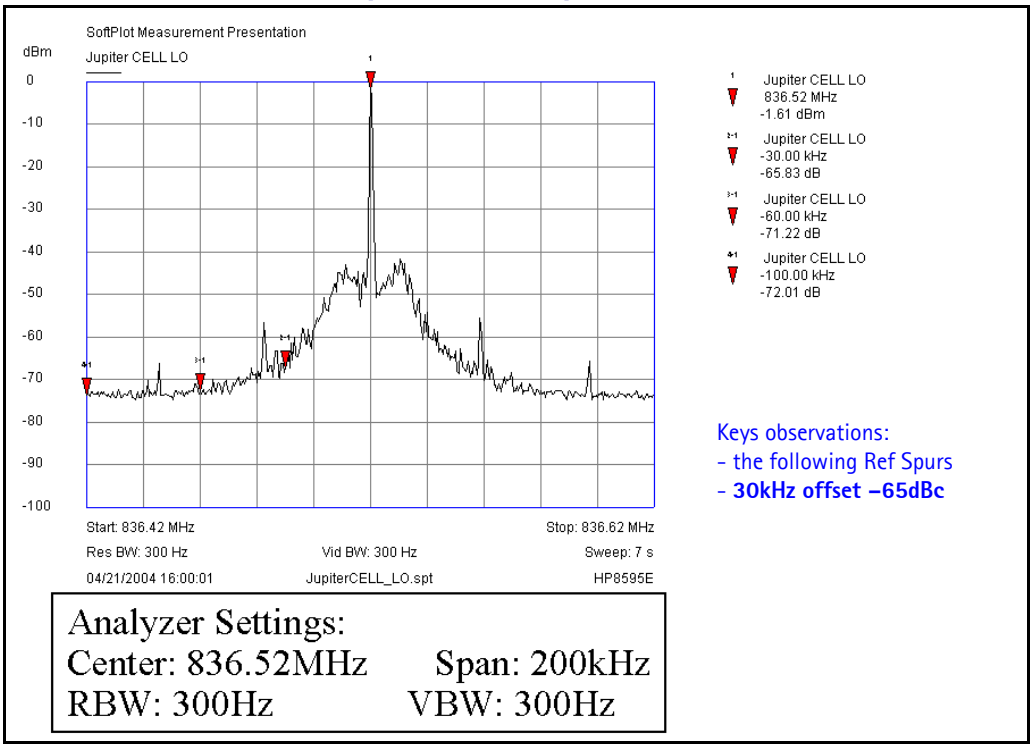

Figure 58: Transmitter UHF LO (3296.16~3395.88)/4 MHz Output for Cell

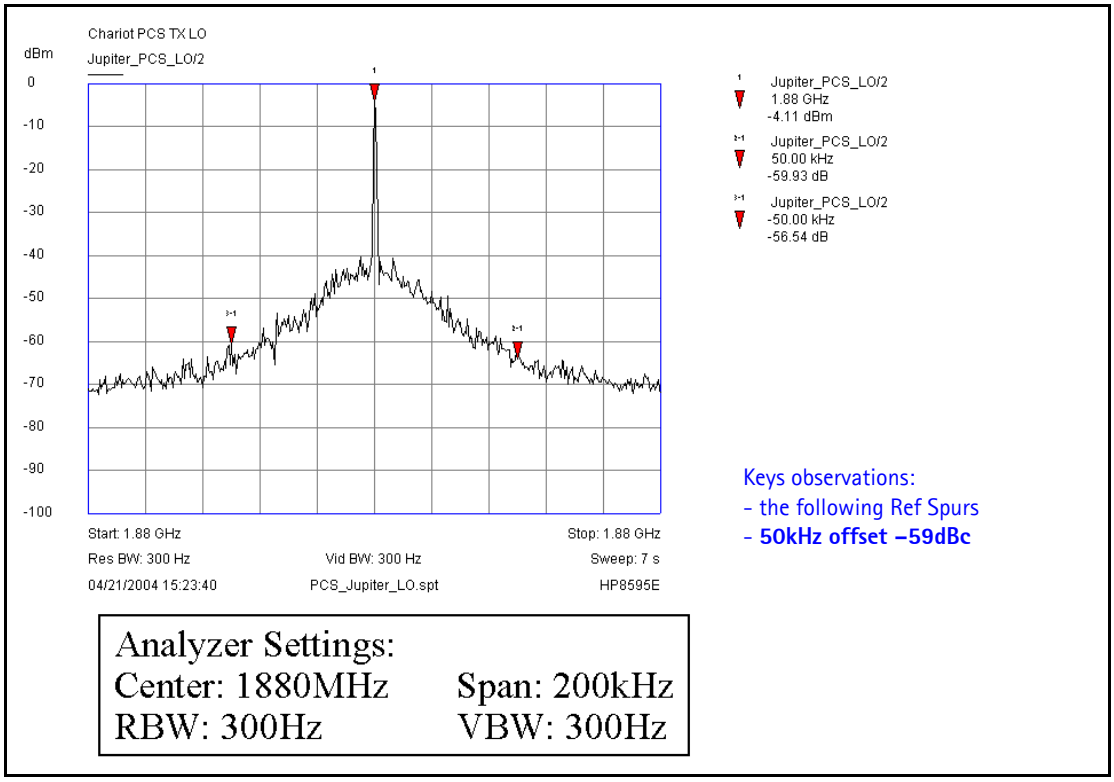

Figure 59: Transmitter UHF LO (3700~3819.90)/2 MHz Output for PCS

GPS Troubleshooting

GPS RF Block Diagram

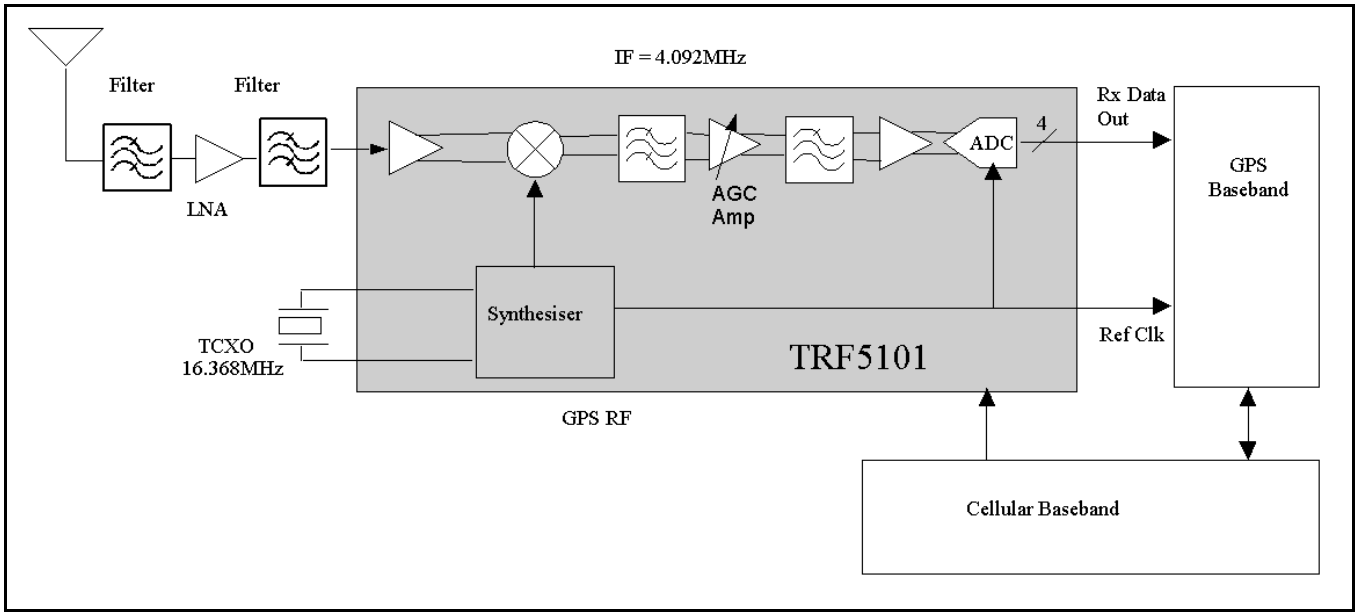

Figure 60: GPS block diagram

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GPS RF Schematic

The following schematic is for general reference only. See the *Schematics* chapter for a detailed version.

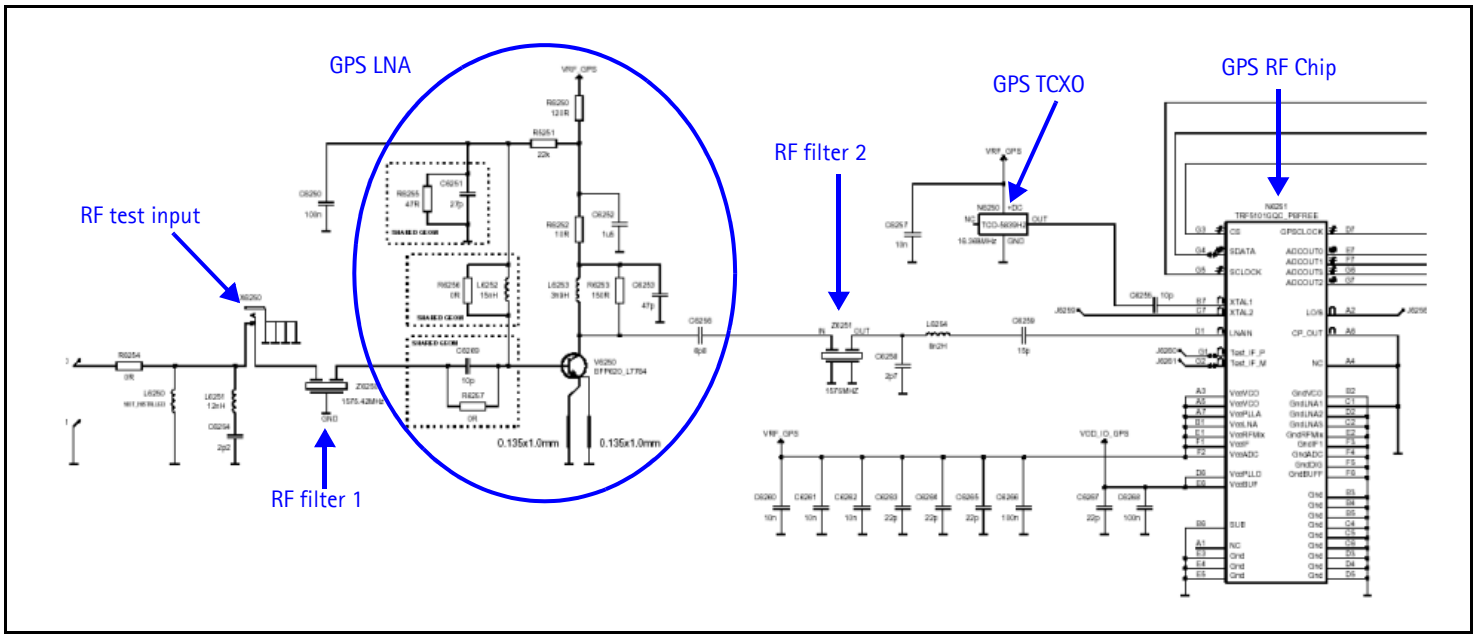

Figure 61: GPS RF schematic

GPS Troubleshooting Setup

Use the following steps to set up GPS signal using Phoenix.

1. On the **Phone Control** dialog box, click the **LOCAL** button in the **Phone State** area to put the mobile terminal into Local Mode. (See Figure 7 on page 11 for an example of the **Phone Control** dialog box.)
2. Click the **Execute** button.

3. Inject a -110dBm tone at 1575.52MHz at the GPS connector (X6250) with a signal generator or call box.

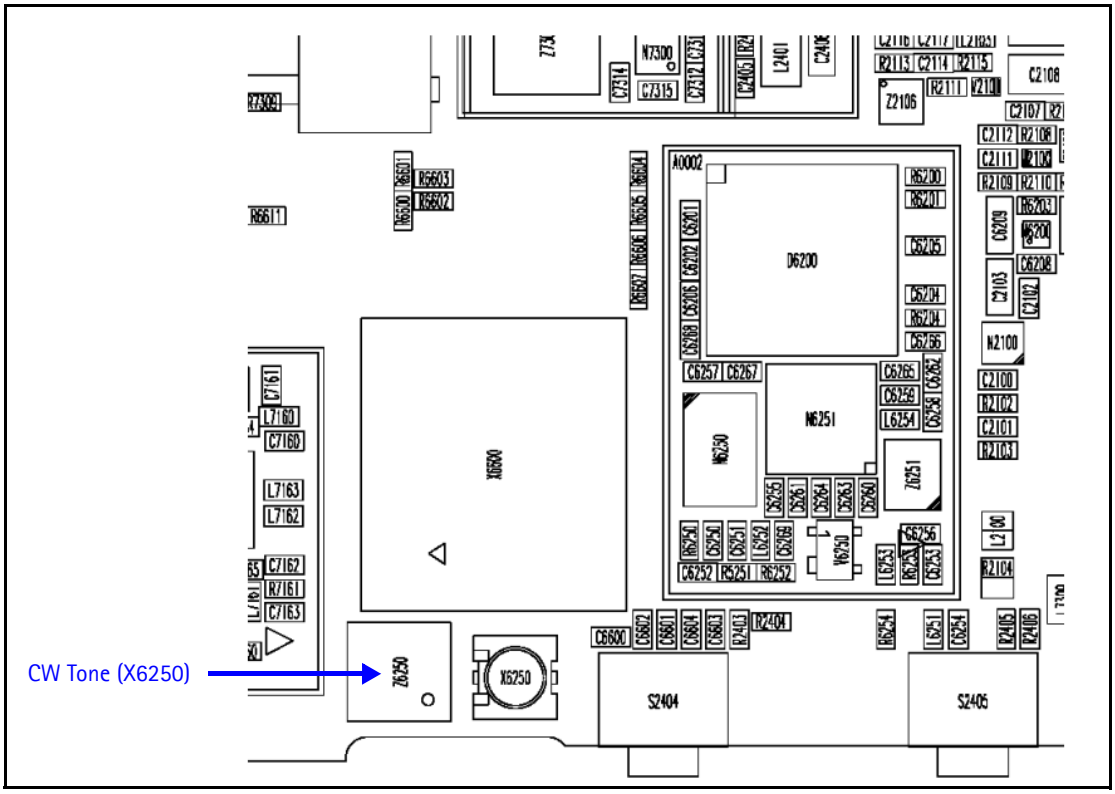

Figure 62: X6250 on the bottom side of the UI PWB

4. Open the **Troubleshooting** menu, and click **GPS Testing**.

   The **GPS Control** dialog box appears.

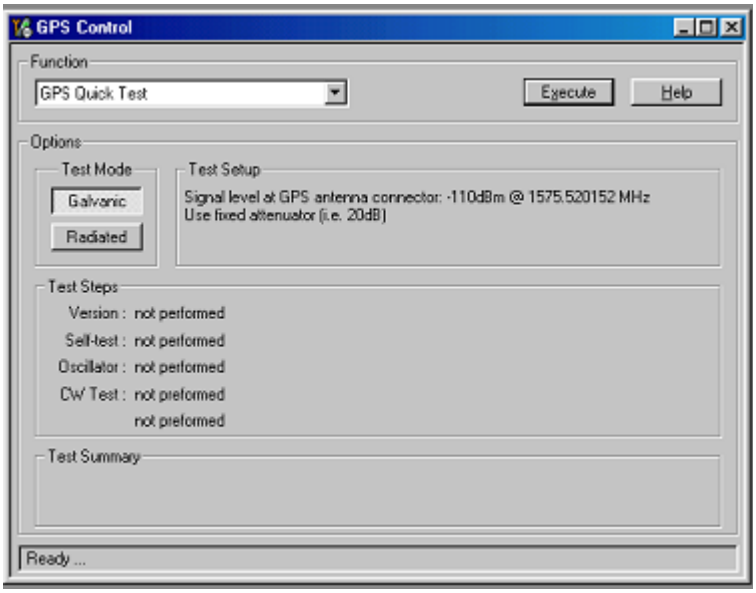

Figure 63: GPS Control dialog box

5. In the **Test Mode** field, ensure that **Galvanic** is selected.
6. Click **Execute**.

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Self Test Failure

If the test fails, repeat steps 1—6. If the test fails again, continue with the following self-test failure troubleshooting:

1. Verify the DC voltages at VRF_GPS and VIO_GPS. ("GPS DC Test Points" on page 64 for test point locations and values.)
2. Inspect all GPS circuit elements around the GPS BB chip (D6200).
3. If the elements pass a visual inspection, replace the D6200.

Oscillator Failure

1. Inspect all GPS circuit elements around the GPS RF chip (N6251).
2. If the elements pass a visual inspection, replace the GPS TCXO (N6250).

CW Test Failure

1. Check that the signal generator is on and sourcing a signal to the GPS RF input port (X6250).
2. Inspect all GPS RF circuit elements.
3. Probe the GPS RF test points on page 65.
4. If the elements pass a visual inspection and the RF is good, replace the GPS RF IC (N6250).

GPS RF Troubleshooting

Use the following steps to trouble shoot the GPS receiver.

1. On the **GPS Control** dialog box, select **On**.
2. Click **Execute**.

Figure 64: Turning on the GPS receiver on the GPS Control dialog box

3. Inject a -50dBm tone at 1575.52MHz at the GPS connector (X6250) with a signal generator or a call box. (See Figure 62.)

GPS DC Test Points

Measure the following test points with an AAS-10B probe and spectrum analyzer set at center frequency 1575.25MHz (span = 500kHz), or with a voltmeter as required.

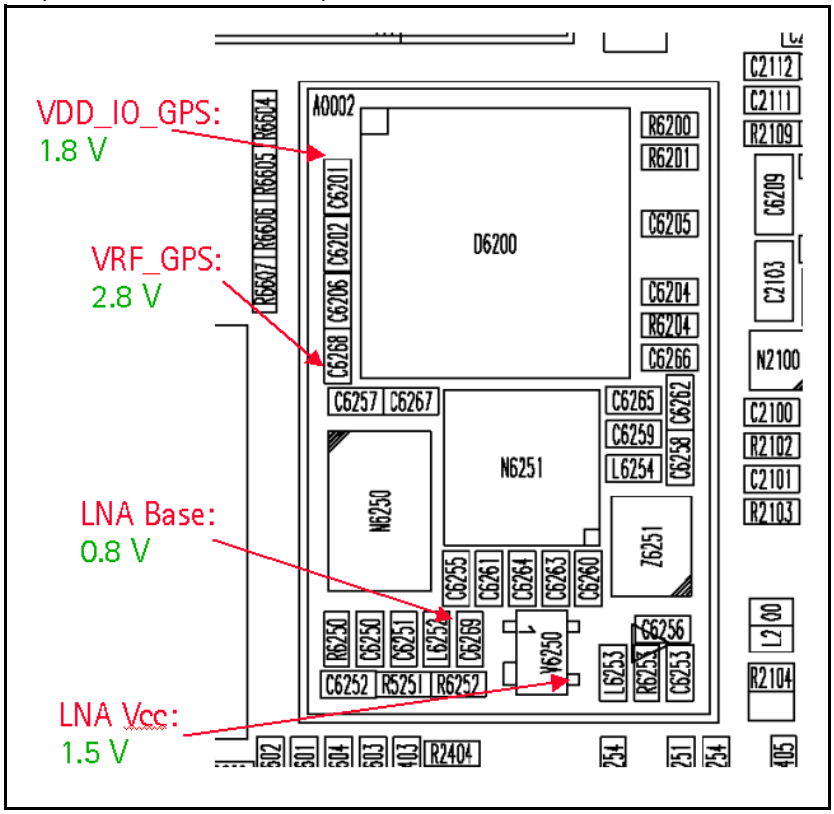

Figure 65: GPS DC probe points on the bottom side of PWB

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GPS RF Test Points

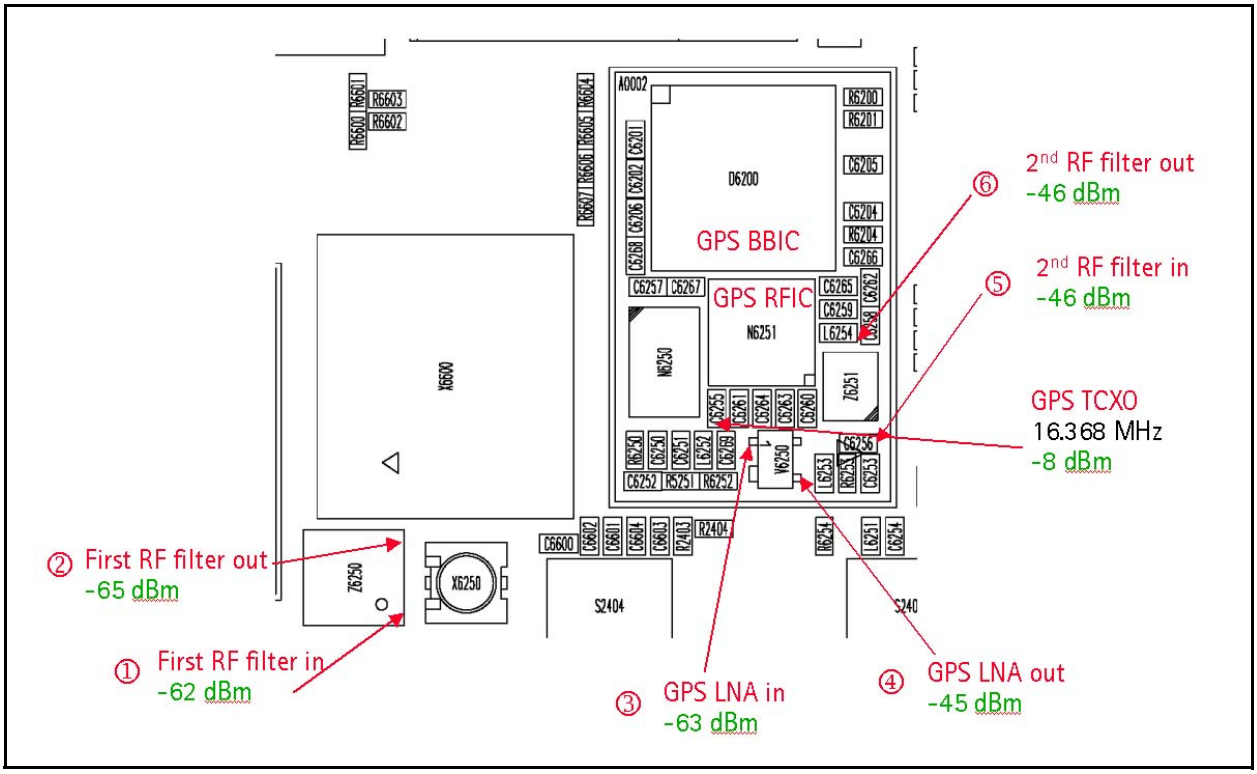

Figure 66: GPS RF probe points on bottom side of PWB

FM Radio Troubleshooting

FM Radio Schematic

The following schematic is for general reference only. See the *Schematics* chapter for a detailed version.

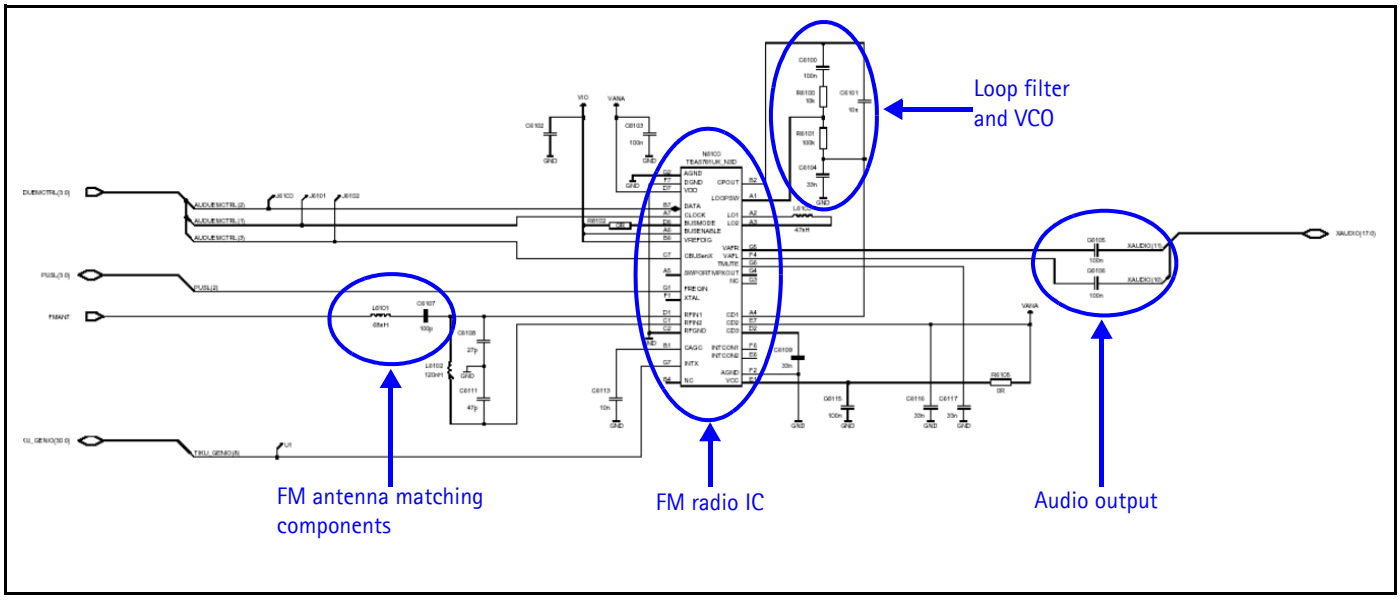

Figure 67: FM radio schematic

FM Radio Troubleshooting Setup

Use the following steps to troubleshoot the FM radio while using a Pop-port headset.

1. Connect the Pop-port headset (HDS-3) to the Pop-port connector (bottom connector).
2. Select the **Menu** > **Media** > **Radio** from the mobile terminal user interface.
3. In an FM radio broadcast coverage area, set a local radio channel by scanning automatically using the **Automatic tuning** option. (Scanning up and down the channels by pressing the "Up" and "Down" key respectively).
4. If no channel could be found, inspect all the components in the FM radio circuitry.
   - If the circuits pass a visual inspection, check the existence of the LO (by radiative pickup) near the VCO of the FM Radio IC.
   - If no LO is found, replace the FM radio IC.
5. Listen for sound out of the headset.
   - If there is a signal present, continue to step 6.
   - If there is no static sound present, inspect all FM Radio circuits on the PCB and refer to the "Audio" section of the *Baseband Description and Troubleshooting* chapter for more information.
6. Disconnect the Pop-port headset and connect the universal headset to the UHJ (top connector).
7. With the universal headset connected, repeat steps 1—5.
   - If there is a signal present, the FM Radio is working properly.
   - If there is no static sound present, refer to the "Audio" section of the *Baseband Description and Troubleshooting* chapter for more information.

FM Radio Part Layouts and Probe Points

Use the following values when probing the LO near the VCO of the FM radio IC (N6100). See Figure 68 for the location of the N6100.

Table 9: FM Radio Test Point Values

Description	Value
LO frequency	(Rx frequency + IF frequency) x 2
IF frequency	225kHz

For example, if the Rx frequency is 87.5 and the IF frequency is 225kHz, the LO equals 175.45MHz [(87.5+0.225)*2 = 175.45MHz].

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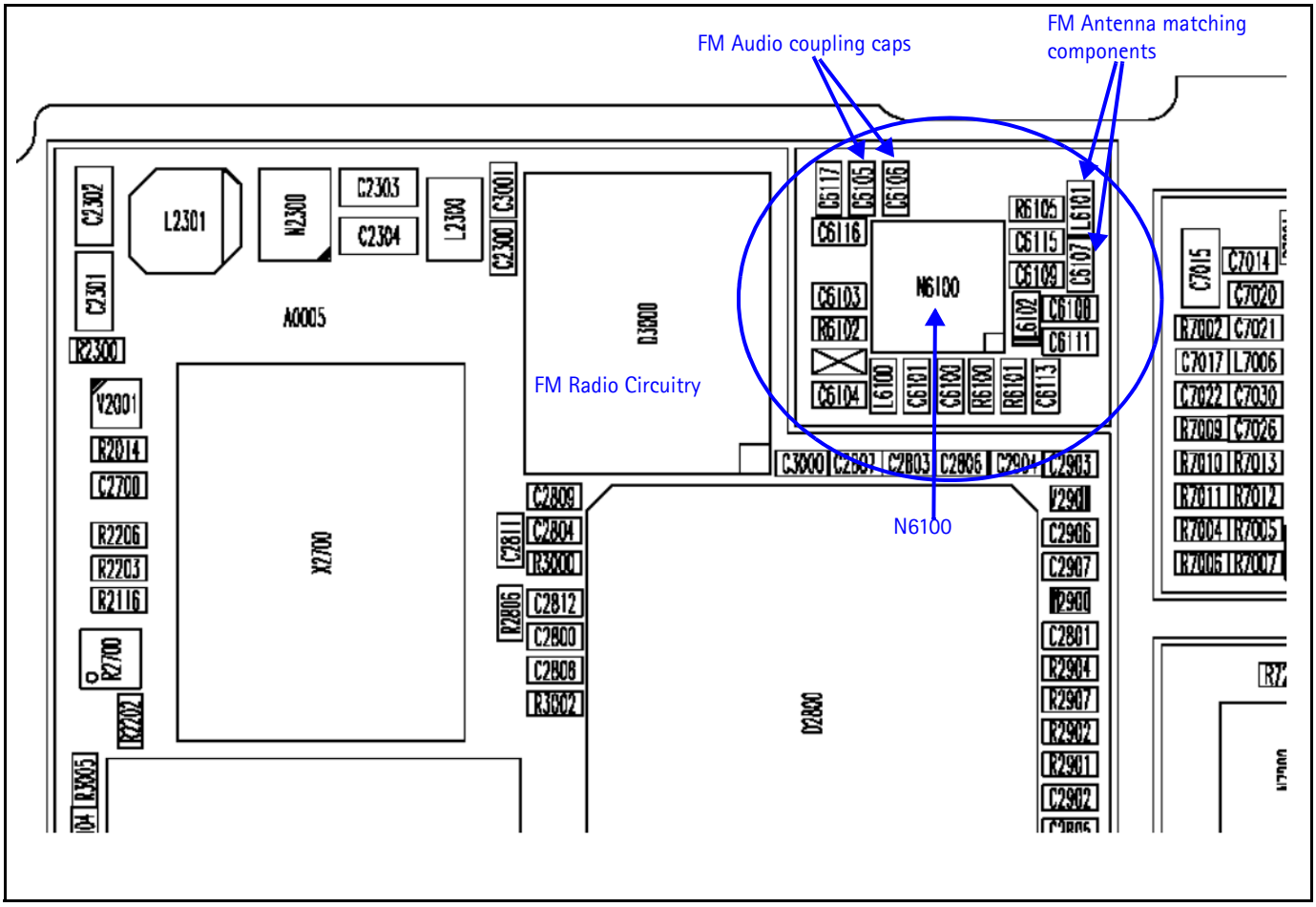

Figure 68: FM radio parts on the bottom side of the main PWB

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